AD-A057 155 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN VOYAGE 33.(U)
AUG 78 J F DALZELL N00024-74-C-5451
UNCLASSIFIED SIT-DL-77-1933 SSC-SL-7-17 NL

1 OF 2
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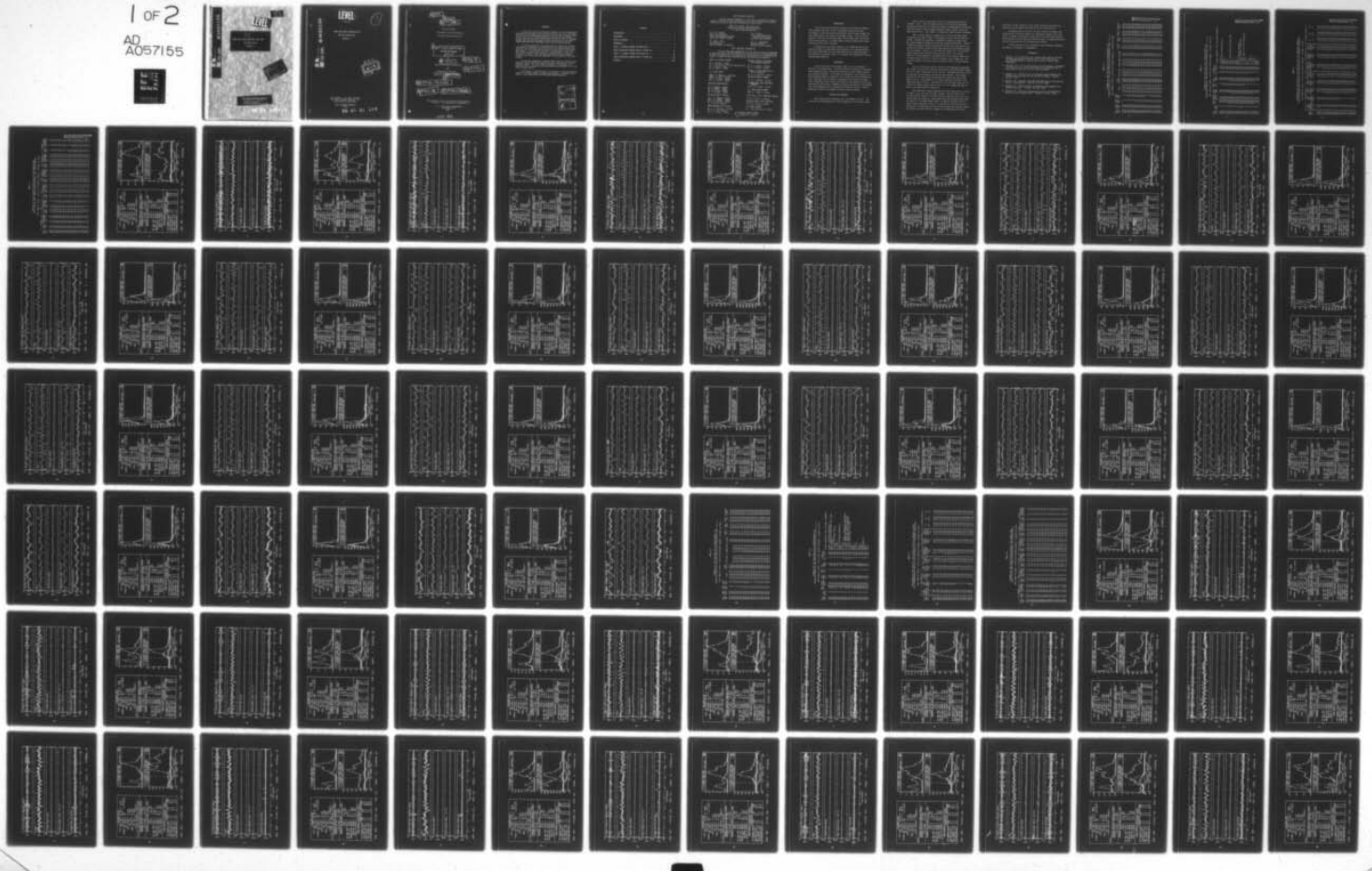

LEVEL II

SL-7-17

RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND McLEAN VOYAGE 33

SHIP STRUCTURE COMMITTEE
1978

18 SSC

19 SL-7-17

9 TECHNICAL REPORT,

on

Project SR-1221

"Correlation and Verification of

Wavemeter Data from the SL-7"

6 RADAR AND TUCKER WAVEMETER DATA
FROM SEA-LAND McLEAN
VOYAGE 33,

by

10 J. F. Dalzell
Stevens Institute of Technology

11 Aug 78

12 123 p.

under

Department of the Navy
Naval Ship Engineering Center
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U. S. Coast Guard Headquarters
Washington, D.C.
1978

ABSTRACT

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Second Season Voyage 33.

CONTENTS

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INTRODUCTION

It was one of the objectives of the SL-7 full-scale instrumentation program to provide a direct instrumental measure of the wave environment so that more precise correlations could be made between full-scale observations, and analytical and model results. To this end the ship was fitted with a micro-wave radar relative wave meter and various motion sensing devices. A "Tucker Meter" pressure actuated wave height sensing system was also installed.

The purpose of the present project is to reduce and analyze the resulting radar and Tucker meter data obtained on the SEA-LAND McLEAN in the second (1973-1974) and third (1974-1975) winter recording seasons. The purpose of the present report is to present the reduced data from the Second Season Voyage 33.

BACKGROUND

Since the purpose of the present report is only to document a portion of the reduced data, it should be noted that details of the experiments themselves, and of the analyses leading up to the present results, are contained elsewhere. To be specific, References 1 and 2 contain, for both recording seasons in question, a full account of the instrumentation, basic recording, and the nominal circumstances surrounding the present data. References 3 and 5 contain the detail of the reduction of the original data to digital form. Reference 4 contains the detail of the analyses and of the procedures used in generating the present results. Finally, Reference 6 contains the summary, discussion and conclusions.

NOTES ON THE CONTENTS

Each voyage leg was processed, and is presented, as a unit. The first part of the presentation for each voyage leg is a four-part table.

Parts a and b of each table contain the log-book data extracted from Ref. 1 or 2. With the exception of the first column of each page, the meaning of each entry is that established by Teledyne Materials Research. The first column is the run number assigned to each interval during the digitization at D.L. This number is retained for identification throughout.

Part c of each table is a comparison of results from the present digitization with that at TMR. Five columns are stress results obtained at TMR. Stresses are presented in thousands of pounds per square inch. The columns marked 6 through 8 are from the present digitization. Column 6 "range of recorded extremes" was computed from the first pass analysis by scaling the extremes in each interval and subtracting the smallest extreme from the largest. Column 7 is $2\sqrt{2}$ times the process rms. This estimate should compare with the value given by TMR for "rms P to T stress,". Column 8 is the difference of the sample mean of the interval noted, from the sample mean of the first interval digitized in each voyage leg. The remaining columns are various ratios of present results to those obtained by TMR.

Part d of the tables involves indices of the magnitude of raw radar, roll, pitch, vertical and transverse acceleration, and Tucker meter signals. The first index in each case is 4.0 x the rms. The second and third indices are the positive and negative extremes for each channel. The extremes observed for roll and pitch were corrected for electrical zero on tape before scaling. The extremes for all other items were corrected to the sample mean before scaling. The senses of pitch and Tucker meter are not correct for reasons noted in Ref. 4, and it is to be emphasized that all data is raw (uncorrected for anything).

The second part of the presentation for each voyage leg is a series of charts, a pair of charts for each interval. The first of the pair includes plots of spectra of midship vertical bending stress, roll, corrected radar wave elevation, Tucker meter wave, and the mean dynamic head at frame 119. The "mean dynamic head" is a partial correction of the Tucker meter as detailed in Ref. 4. At the left of the first chart is a tabulation of various data; portions of the log book data from the tables, two indices of midship stress, a summary of the magnitude of motions,

and finally a table summarizing wave height statistics obtained from spectra as well as peak-trough analyses of the time histories.

The second chart of the pair for each interval are sample time histories for five of the channels of information treated in the first chart. As noted in Reference 4, there was at the end of data reduction 16-1/2 minutes of valid radar wave elevation data. To produce the charts an 8-1/2 minute portion of this sample was selected.

A fuller discussion of the background and conventions employed in the charts is presented in the Appendix.

REFERENCES

1. Wheaton, J.W. and Boentgen, R.R., "Second Season Results from Ship Response Instrumentation Aboard the SL-7 Class Containership S.S. SEA-LAND McLEAN in North Atlantic Service," SL-7-9, 1976, AD-A034162.

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3. Dalzell, J.F., "Original Radar and Standard Tucker Wavemeter SL-7 Containership Data Reduction and Correlation Sample," SSC-277, SL-7-14. 1978.

4. Dalzell, J.F., "Wavemeter Data Reduction Method and Initial Data for the SL-7 Containership," SSC-278, SL-7-15. 1978.

5. Dalzell, J.F., "Modified Radar and Standard Tucker Wavemeter SL-7 Containership Data," SSC-279, SL-7-20. 1978.

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TABLE Ia

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 EAST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
601	149	1	1	01-17-74	1600	40-20 N	70-19 W	090	32.2	130.4	30.04	48/35
605	149	2	5	01-17-74	2000	40-20 N	70-19 W	079	32.3	131.0	30.01	47/36
609	149	3	9	01-17-74	2400	40-20 N	70-19 W	079	32.1	130.0	30.05	48/24
613	149	4	13	01-18-74	0400	40-20 N	70-19 W	079	29.7	120.6	30.01	65/20
621	149	6	21	01-18-74	1200	40-20 N	70-19 W	078	32.5	131.9	29.96	60/29
625	149	7	25	01-18-74	1600	42-17 N	55-25 W	078	32.4	131.3	29.93	54/34
629	149	8	29	01-18-74	2000	42-17 N	55-25 W	078	32.3	131.0	29.80	48/34
633	149	9	33	01-18-74	2400	42-17 N	55-25 W	078	32.4	131.3	29.88	34/33
637	149	10	37	01-19-74	0400	42-17 N	55-25 W	077	32.5	131.6	29.80	48/33
641	149	11	41	01-19-74	0800	42-17 N	55-25 W	077	32.5	131.9	29.75	40/34
645	149	12	45	01-19-74	1100	42-17 N	55-25 W	077	32.2	130.7	29.63	54/45
649	149	13	49	01-19-74	1310	44-30 N	39-55 W	077	32.2	130.7	29.63	54/45
653	149	14	53	01-19-74	1530	44-30 N	39-55 W	078	32.4	131.5	29.67	55/47
657	149	15	57	01-19-74	1740	44-30 N	39-55 W	078	32.4	131.5	29.67	55/47
702	151	17	2	01-19-74	2000	44-30 N	39-55 W	078	32.5	131.7	29.81	65/48
705	151	18	5	01-19-74	2400	44-30 N	39-55 W	078	32.4	131.4	29.83	55/43
709	151	19	9	01-20-74	0400	44-30 N	39-55 W	078	32.5	131.6	29.88	53/49
713	151	20	13	01-20-74	0800	44-30 N	39-55 W	078	32.6	132.1	30.00	53/51
717	151	21	17	01-20-74	1200	46-57 N	23-30 W	079	32.4	131.3	30.00	53/58
721	151	22	21	01-20-74	1600	46-57 N	23-30 W	079	32.7	132.6	30.00	52/52
725	151	23	25	01-20-74	2000	46-57 N	23-30 W	077	32.7	132.5	30.07	52/52
729	151	24	29	01-20-74	2400	46-57 N	23-30 W	077	32.0	129.6	29.89	52/50
733	151	25	33	01-21-74	0400	46-57 N	23-30 W	077	32.3	131.1	29.95	53/54
737	151	26	37	01-21-74	0800	46-57 N	23-30 W	077	32.9	133.4	30.10	52/54

TABLE Ib

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 EAST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
601	6	45P/25	90P	4	90P	10	400	PT CLDY /
605	7	79P/30	79P	8	79P	10	400	OCAST /SHIP RIDING EASILY
609	8	79P/35	79P	10	79P	12	400	OCAST /
613	8	79P/38	79P	10	79P	12	400	OCAST /
621	7	78P/30	78P	12	78P	12	400	CLDY /
625	8	100P/35	78P	20	78P	12	400	CLDY /
629	8	145P/35	145P	20	123P	12	500	CLDY /SHIPPING WATER OVER BOW
633	8	123P/35	123P	20	123P	12	500	CLDY /
637	9	122P/35	122P	20	122P	15	500	OCAST /
641	8	122P/35	122P	20	122P	15	500	CLDY /
645	9	167P/40	144P	20	144P	15	500	OCAST /
649	9	167P/40	144P	20	144P	15	500	OCAST /SAW 33 DEG ROLL
653	10	145P/45	145P	25	145P	15	600	PT CLDY /MANUAL OPERATION
657	10	145P/45	145P	20	145P	15	600	PT CLDY /
702	7	145P/35	145P	12	145P	12	600	PT CLDY /BACK IN AUTO OPERATION
705	6	145P/25	145P	8	145P	10	400	PT CLDY /
709	6	123P/25	123P	8	145P	10	400	CLDY /
713	5	168P/25	168P	4	168P	10	400	PT CLDY /
717	5	169P/20	169P	4	169P	8	300	PT CLDY /
721	4	124P/20	124P	4	169S	8	300	PT CLDY /
725	4	167P/20	167P	4	167P	6	300	PT CLDY /
729	6	77P/20	77P	6	77P	6	300	OCAST /
733	6	35S/20	35S	6	35S	4	300	OCAST /
737	5	58S/15	58S	6	58S	4	300	CLDY /

TABLE Ic

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 EAST

	TMR RESULTS					D.L. DIGITIZATION			COLUMN RATIOS		
D.L. RUN NO.	NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	(7) / (4)	(6) / (3+5)	(6) / (3)
601	215	16	2.29	1.01	1.19	3.54	1.40	-0.00	1.38	1.02	1.55
605	156	36	3.75	2.00	1.52	6.09	2.29	0.11	1.14	1.16	1.63
609	96	36	6.73	3.40	2.61	7.88	3.38	0.18	0.99	0.84	1.17
613	97	51	7.83	3.41	2.29	10.41	4.26	0.04	1.25	1.03	1.33
621	73	38	9.69	4.50	1.57	12.89	5.75	-0.34	1.28	1.14	1.33
625	66	31	10.05	4.92	1.47	11.75	5.95	-0.56	1.21	1.02	1.17
629	58	17	10.33	4.77	1.36	12.22	5.58	-0.16	1.17	1.05	1.18
633	61	18	12.88	5.14	1.55	14.91	6.91	-0.24	1.34	1.03	1.16
637	52	19	13.83	6.78	1.12	16.92	7.81	-0.05	1.15	1.13	1.22
641	59	10	9.69	4.28	0.97	14.64	6.52	0.01	1.52	1.37	1.51
645	53	21	14.47	5.99	1.15	17.84	8.04	0.13	1.34	1.14	1.23
649	60	36	11.41	5.80	1.44	17.04	7.27	0.02	1.25	1.33	1.49
653	51	23	17.56	6.89	1.47	15.90	8.02	-0.27	1.16	0.84	0.91
657	47	18	13.01	7.06	1.41	16.35	7.60	0.10	1.08	1.13	1.26
702	74	0	9.02	3.84	0.00	15.11	6.28	-0.21	1.64	1.67	1.67
705	44	1	12.29	6.02	0.79	14.17	6.52	0.01	1.08	1.08	1.15
709	48	3	9.25	4.38	0.85	15.09	6.57	0.37	1.50	1.49	1.63
713	40	2	13.68	5.87	0.85	13.66	7.06	0.15	1.20	0.94	1.00
717	49	1	12.44	4.35	0.85	13.34	6.11	1.13	1.41	1.00	1.07
721	41	1	9.82	4.11	0.79	11.59	5.76	0.71	1.40	1.09	1.18
725	44	14	10.85	3.62	0.97	8.25	3.94	0.26	1.09	0.70	0.76
729	62	16	6.65	2.27	1.01	8.31	3.78	0.50	1.67	1.09	1.25
733	58	3	4.58	1.92	0.87	6.72	3.29	0.38	1.72	1.23	1.47
737	37	0	4.75	2.21	0.00	5.52	2.62	0.72	1.19	1.16	1.16

TABLE Id

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 EAST

D.L. RUN NO.	<--- RADAR ---> 4.0 (RMS) FT	RECORDED EXTREMES FT	FT	<--- ROLL ----> 4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	<--- PITCH ---> 4.0 (RMS) DEG	RECORDED EXTREMES DEG	DEG	<--VERT ACCEL-> 4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	<--LAT ACCEL--> 4.0 (RMS) (G)	RECORDED EXTREMES (G)	(G)	<-- TUCKER --> 4.0 (RMS) FT	RECORDED EXTREMES FT	FT
601	11.	9.	-9.	3.1	6.	0.	0.5	-0.0	-1.0	0.09	0.1	-0.1	0.09	0.1	-0.1	2.	2.	-2.
605	18.	14.	-21.	6.9	10.	-3.	0.9	0.4	-1.3	0.20	0.2	-0.2	0.18	0.2	-0.2	3.	3.	-3.
609	27.	26.	-22.	18.5	18.	-9.	0.7	0.2	-1.1	0.18	0.1	-0.1	0.44	0.3	-0.4	4.	4.	-3.
613	29.	27.	-28.	19.8	20.	-11.	1.3	1.1	-1.7	0.32	0.3	-0.3	0.45	0.4	-0.3	6.	8.	-6.
621	36.	33.	-28.	27.8	25.	-12.	1.1	0.8	-1.4	0.27	0.2	-0.2	0.63	0.4	-0.5	9.	9.	-7.
625	36.	29.	-36.	24.9	22.	-15.	1.0	0.3	-1.3	0.21	0.2	-0.2	0.55	0.5	-0.4	8.	8.	-6.
629	34.	29.	-23.	24.7	23.	-12.	0.8	0.4	-1.1	0.15	0.2	-0.1	0.55	0.4	-0.4	8.	9.	-6.
633	39.	39.	-29.	29.4	23.	-16.	1.0	0.7	-1.0	0.16	0.2	-0.1	0.68	0.5	-0.5	9.	8.	-7.
637	44.	46.	-33.	29.0	22.	-15.	1.1	0.7	-1.1	0.16	0.1	-0.1	0.63	0.4	-0.5	9.	10.	-7.
641	42.	44.	-34.	21.2	16.	-13.	1.0	0.6	-1.3	0.22	0.2	-0.2	0.46	0.3	-0.3	7.	6.	-6.
645	52.	49.	-32.	28.2	22.	-15.	1.0	0.5	-1.2	0.20	0.2	-0.2	0.61	0.4	-0.4	7.	7.	-5.
649	48.	42.	-40.	25.9	21.	-14.	1.0	0.4	-1.2	0.21	0.2	-0.2	0.60	0.4	-0.5	10.	9.	-8.
653	56.	45.	-41.	32.2	22.	-20.	1.0	0.5	-1.2	0.18	0.1	-0.2	0.68	0.5	-0.5	11.	9.	-8.
657	53.	49.	-42.	31.5	23.	-17.	1.0	0.3	-1.2	0.17	0.2	-0.1	0.71	0.5	-0.5	11.	10.	-7.
702	50.	53.	-42.	23.1	16.	-17.	1.1	0.5	-1.3	0.24	0.2	-0.2	0.48	0.4	-0.4	18.	10.	-10.
705	49.	34.	-46.	21.6	13.	-14.	1.1	0.6	-1.4	0.22	0.2	-0.2	0.45	0.3	-0.3	18.	10.	-9.
709	49.	43.	-36.	23.1	15.	-19.	0.9	0.3	-1.3	0.16	0.2	-0.2	0.46	0.4	-0.4	20.	10.	-10.
713	50.	50.	-33.	21.1	12.	-19.	0.8	0.2	-1.1	0.14	0.1	-0.1	0.44	0.4	-0.3	19.	11.	-10.
717	43.	34.	-29.	18.7	12.	-16.	0.8	0.3	-1.0	0.13	0.1	-0.1	0.41	0.3	-0.3	19.	10.	-10.
721	44.	38.	-29.	21.4	14.	-15.	0.7	0.2	-1.0	0.09	0.1	-0.1	0.43	0.3	-0.3	23.	11.	-11.
725	23.	17.	-19.	13.2	15.	-4.	0.7	0.3	-0.9	0.09	0.1	-0.1	0.28	0.2	-0.2	8.	6.	-4.
729	22.	17.	-16.	9.7	9.	-11.	0.6	0.2	-1.0	0.08	0.1	-0.1	0.21	0.2	-0.2	13.	10.	-10.
733	20.	22.	-15.	10.4	8.	-9.	0.7	0.1	-1.0	0.07	0.1	-0.1	0.21	0.2	-0.2	12.	10.	-8.
737	15.	14.	-14.	9.6	9.	-7.	0.6	0.1	-0.9	0.06	0.1	-0.0	0.20	0.1	-0.2	9.	6.	-7.

LOG BOOK DATA

DATE AND TIME	01-17-74 1600
POSITION	40-20 N 70-19 W
COURSE AND SPEED	090 , 32.2 KNOTS
SEA STATE	6
WAVE HEIGHT	4 FEET
" REL DIR	90 PORT
SWELL HEIGHT	10 FEET
" REL DIR	90 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

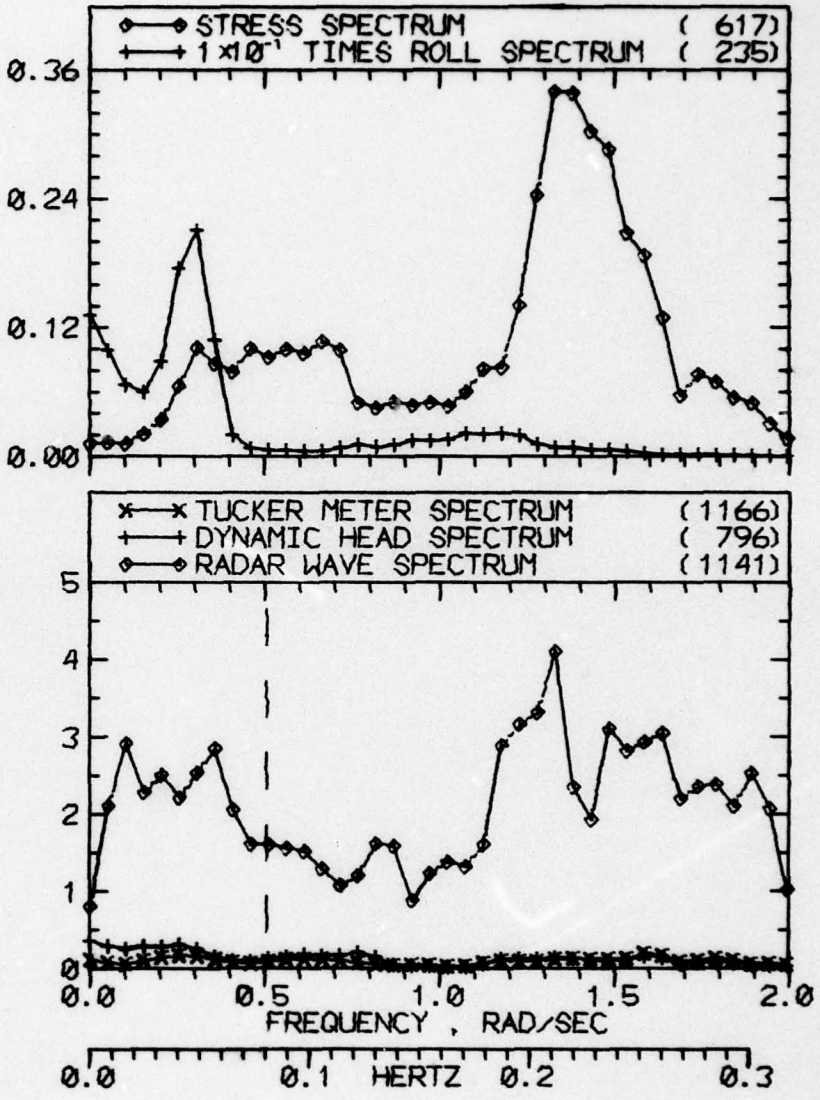
MAXIMUM PK-TR	2.3 KPSI
4.0 X RMS	2.0 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

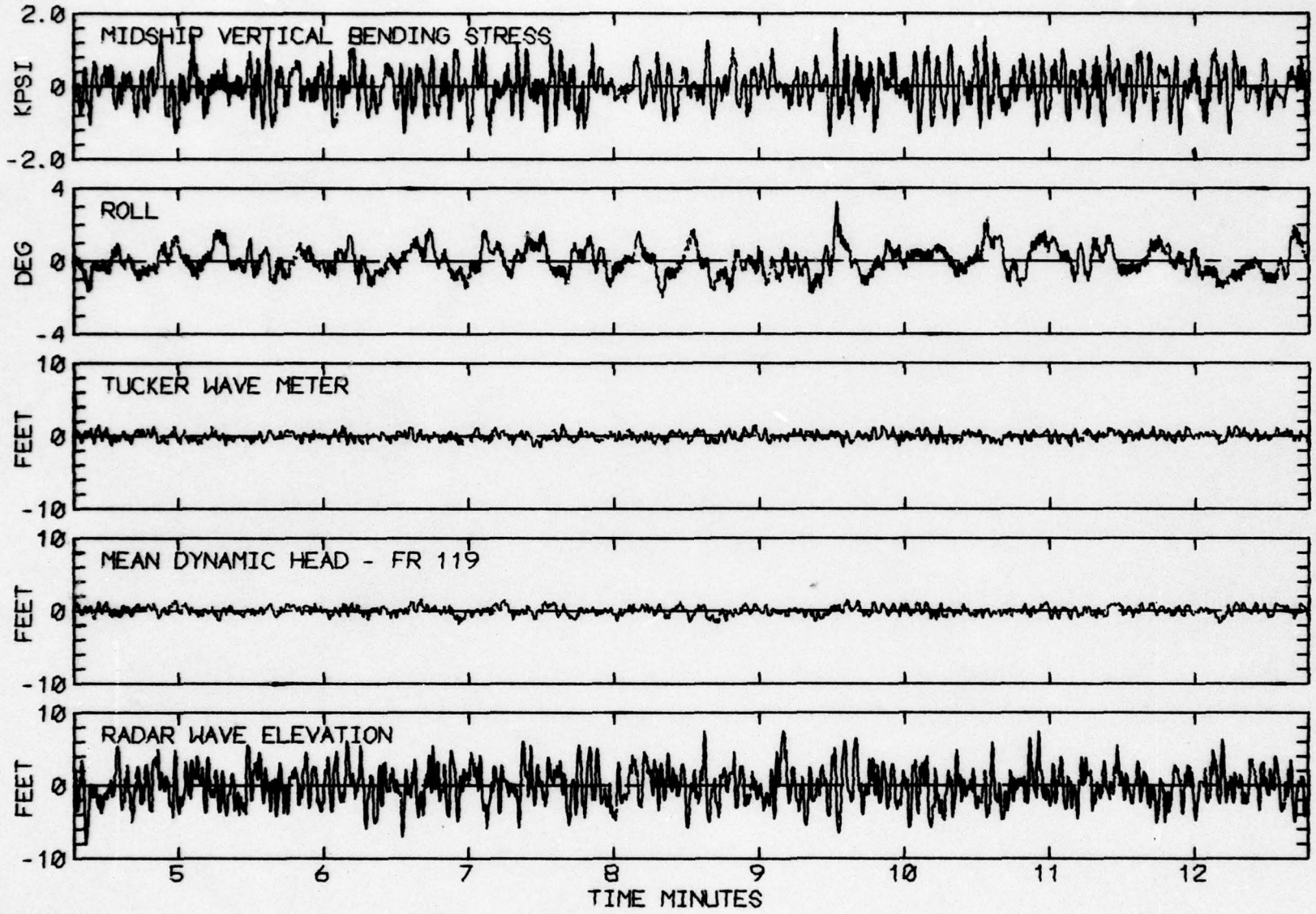
ROLL	3.1 DEG
PITCH	0.54 DEG
DK HSE VERT ACCEL	0.09 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	10.9 FEET
VERTICAL RANGE	10.3 FEET
DISPL AT RADAR	3.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	407	341	338
MAXIMUM HEIGHT	2.6	2.7	13.0
10TH HIGHEST HTS	2.1	2.2	9.9
3RD HIGHEST HTS	1.7	1.8	8.2
4.0 RMS(SPECTRA)	2.1	2.3	9.5



RUN 601 -- VOYAGE 33E -- TAPE 149 -- INDEX 1 -- INTERVAL 1



RUN 601 -- VOYAGE 33E -- TAPE 149 -- INDEX 1 -- INTERVAL 1

LOG BOOK DATA

DATE AND TIME	01-17-74 2000
POSITION	40-20 N 70-19 W
COURSE AND SPEED	079 . 32.3 KNOTS
SEA STATE	7
WAVE HEIGHT	8 FEET
" REL DIR	79 PORT
SWELL HEIGHT	10 FEET
" REL DIR	79 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /SHIP RIDING EASILY

MIDSHIP VERTICAL BENDING STRESS

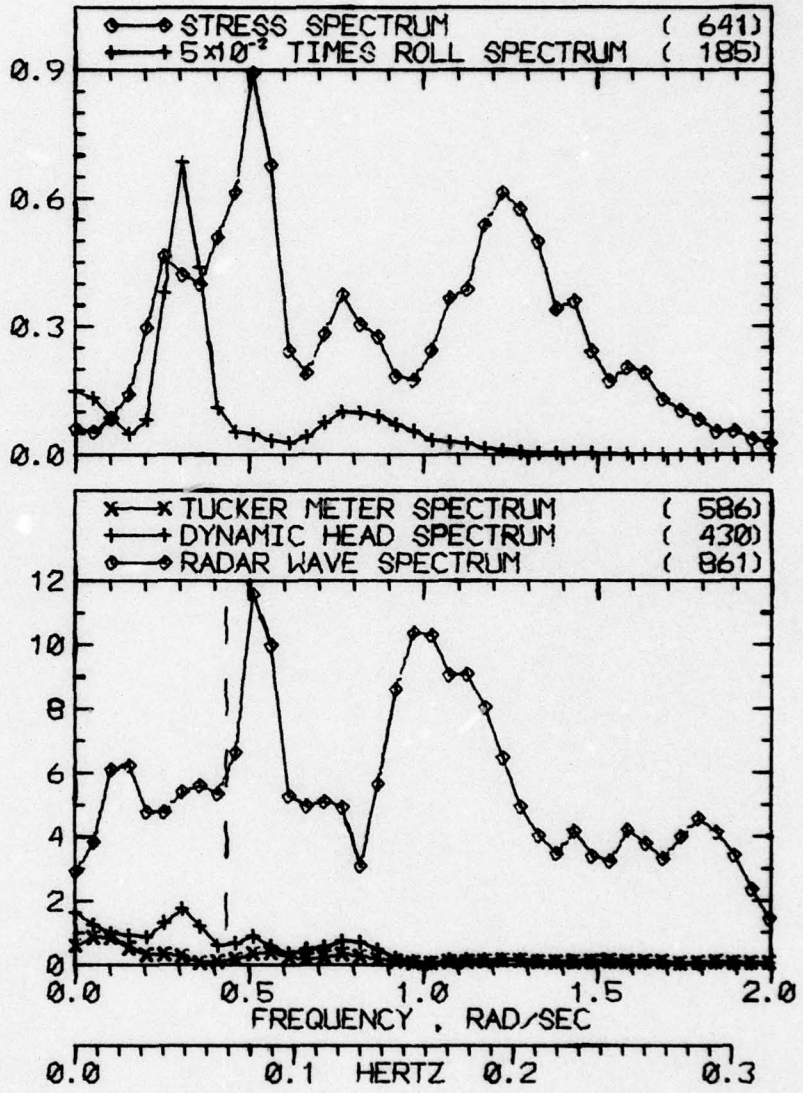
MAXIMUM PK-TR	3.7 KPSI
4.0 X RMS	3.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

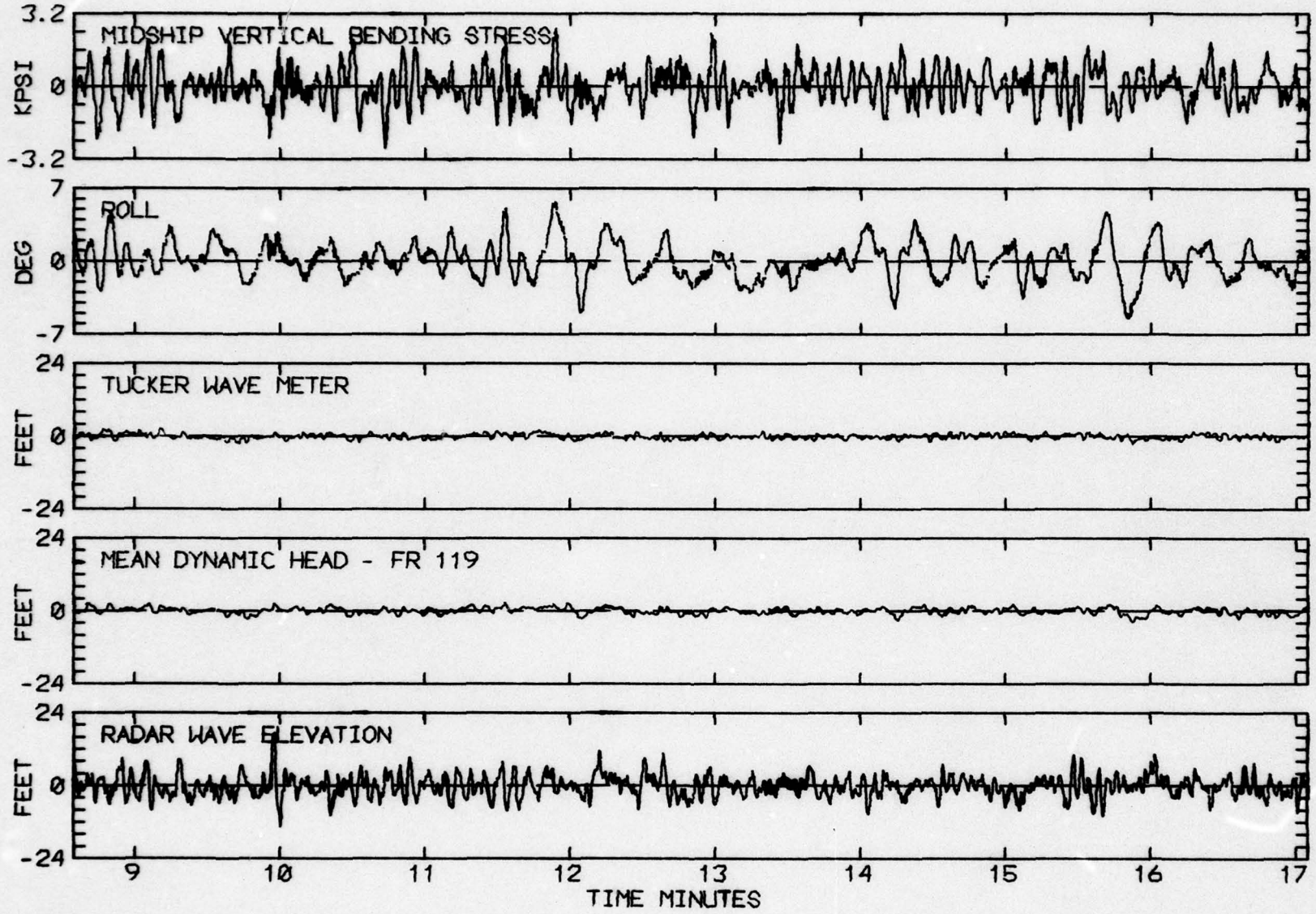
ROLL	6.9 DEG
PITCH	0.87 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.18 G
RADAR SLANT RANGE	17.8 FEET
VERTICAL RANGE	17.0 FEET
DISPL AT RADAR	8.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	290	201	265
MAXIMUM HEIGHT	3.9	5.6	31.1
10TH HIGHEST HTS	2.5	4.0	15.5
3RD HIGHEST HTS	2.1	2.8	12.2
4.0 RMS(SPECTRA)	2.8	3.9	14.3



RUN 605 -- VOYAGE 33E -- TAPE 149 -- INDEX 2 -- INTERVAL 5



RUN 605 -- VOYAGE 33E -- TAPE 149 -- INDEX 2 -- INTERVAL 5

LOG BOOK DATA

DATE AND TIME	01-17-74 2400
POSITION	40-20 N 70-19 W
COURSE AND SPEED	079 , 32.1 KNOTS
SEA STATE	8
WAVE HEIGHT	10 FEET
" REL DIR	79 PORT
SWELL HEIGHT	12 FEET
" REL DIR	79 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

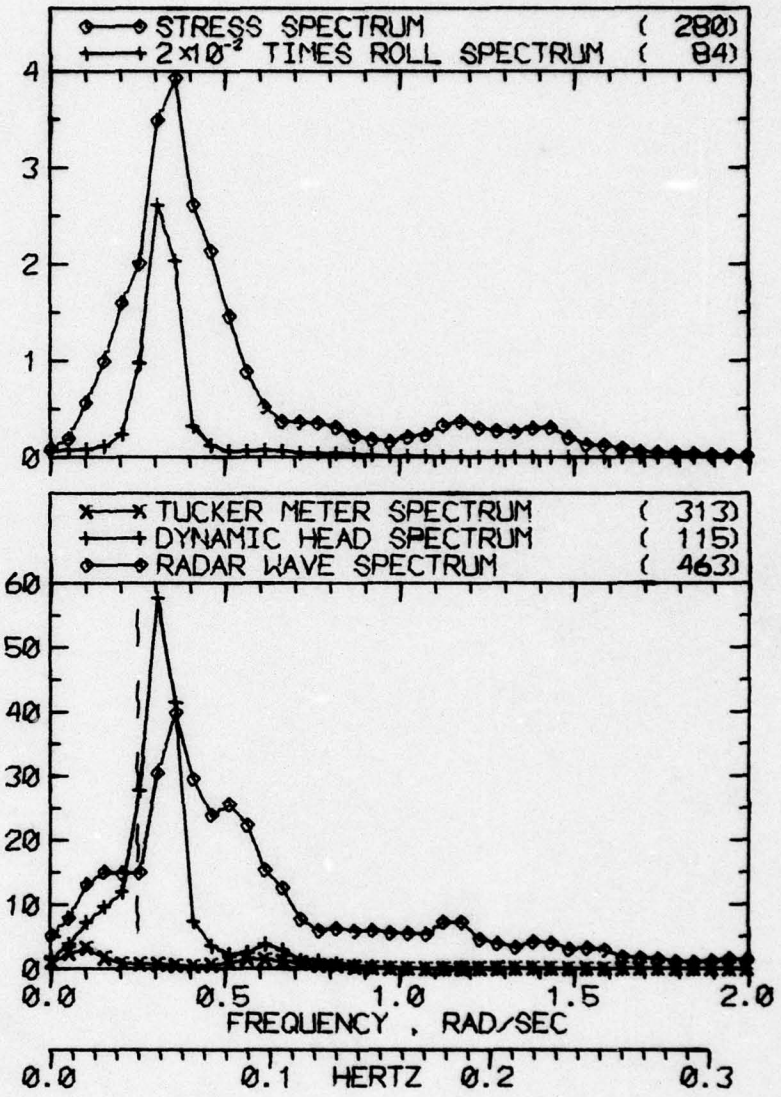
MAXIMUM PK-TR	6.7 KPSI
4.0 X RMS	4.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

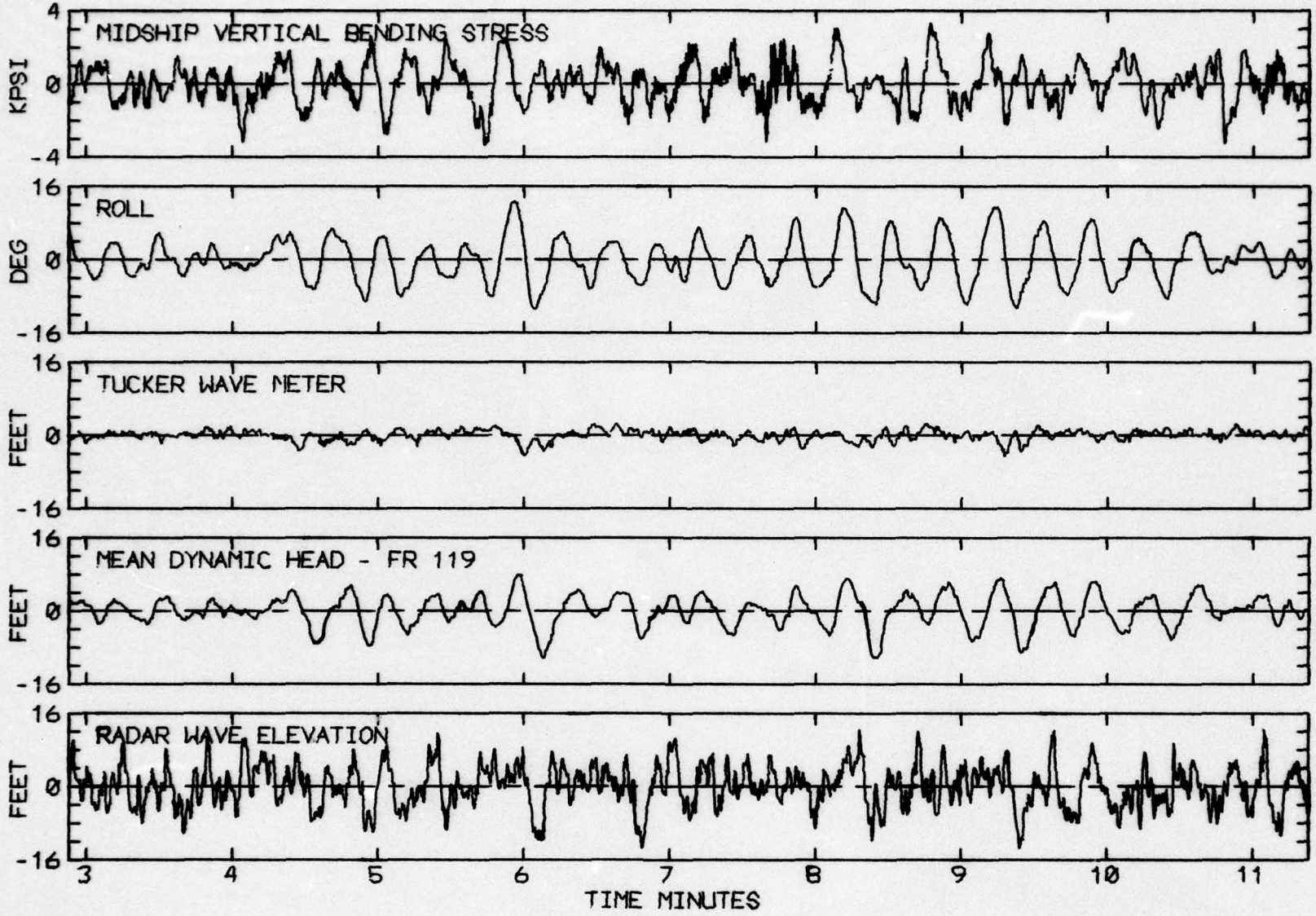
ROLL	17.1 DEG
PITCH	0.75 DEG
DK HSE VERT ACCEL	0.18 G
DK HSE LAT ACCEL	0.44 G
RADAR SLANT RANGE	26.9 FEET
VERTICAL RANGE	21.0 FEET
DISPL AT RADAR	15.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	239	84	207
MAXIMUM HEIGHT	4.9	18.2	24.2
10TH HIGHEST HTS	3.7	14.3	18.2
3RD HIGHEST HTS	2.6	10.5	13.6
4.0 RMS(SPECTRA)	4.3	12.5	18.1



RUN 609 -- VOYAGE 33E -- TAPE 149 -- INDEX 3 -- INTERVAL 9



RUN 609 -- VOYAGE 33E -- TAPE 149 -- INDEX 3 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	01-18-74 0400
POSITION	40-20 N 70-19 W
COURSE AND SPEED	079 . 29.7 KNOTS
SEA STATE	8
WAVE HEIGHT	10 FEET
" REL DIR	79 PORT
SWELL HEIGHT	12 FEET
" REL DIR	79 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

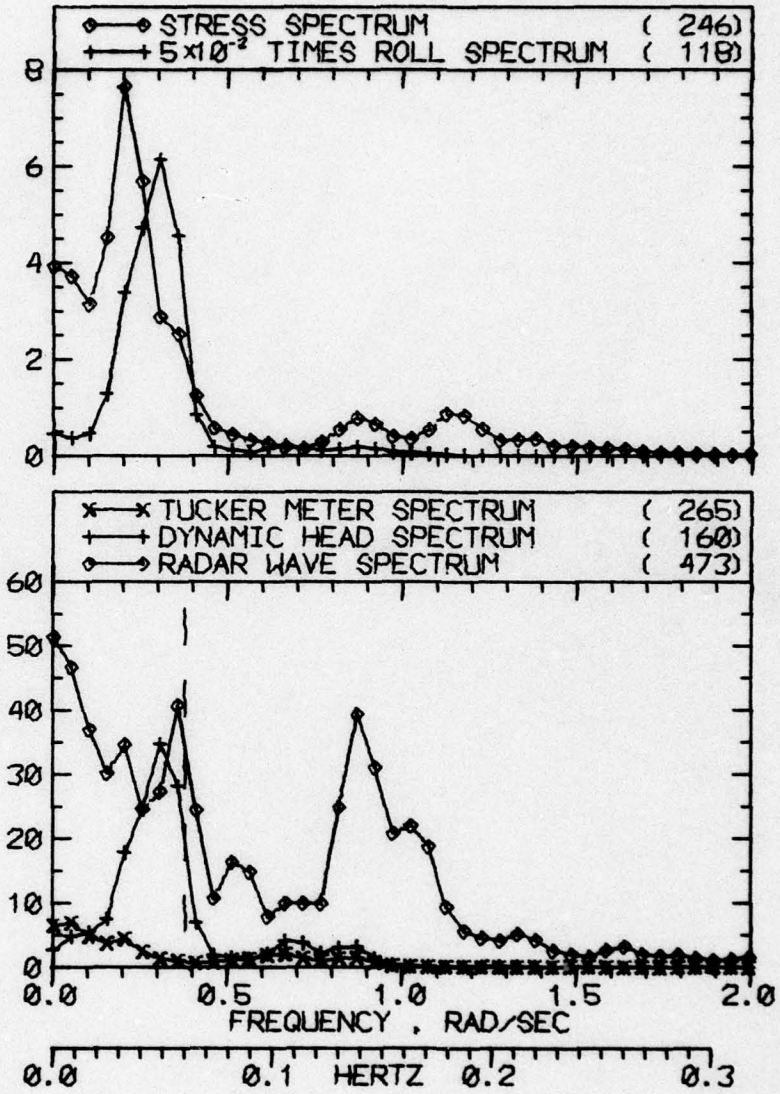
MAXIMUM PK-TR	7.8 KPSI
4.0 X RMS	6.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

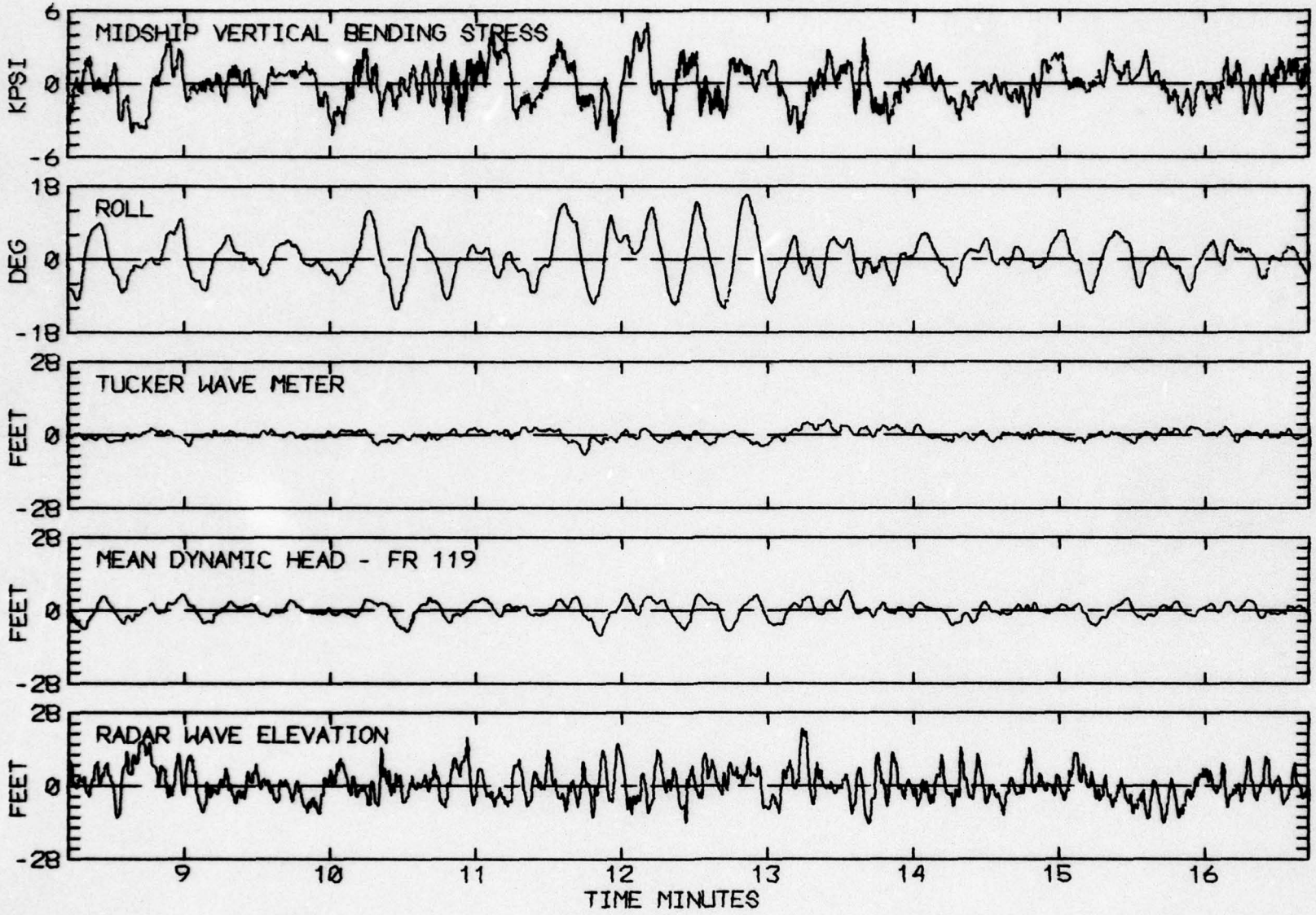
ROLL	19.7 DEG
PITCH	1.30 DEG
DK HSE VERT ACCEL	0.32 G
DK HSE LAT ACCEL	0.45 G
RADAR SLANT RANGE	29.0 FEET
VERTICAL RANGE	25.7 FEET
DISPL AT RADAR	17.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	163	85	172
MAXIMUM HEIGHT	10.6	14.8	29.8
10TH HIGHEST HTS	5.5	13.0	23.3
3RD HIGHEST HTS	4.0	9.6	18.4
4.0 RMS(SPECTRA)	6.1	11.4	22.5



RUN 613 -- VOYAGE 33E -- TAPE 149 -- INDEX 4 -- INTERVAL 13



RUN 613 -- VOYAGE 33E -- TAPE 149 -- INDEX 4 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	01-18-74 1200
POSITION	40-20 N 70-19 W
COURSE AND SPEED	078 . 32.5 KNOTS
SEA STATE	7
WAVE HEIGHT	12 FEET
" REL DIR	78 PORT
SWELL HEIGHT	12 FEET
" REL DIR	78 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

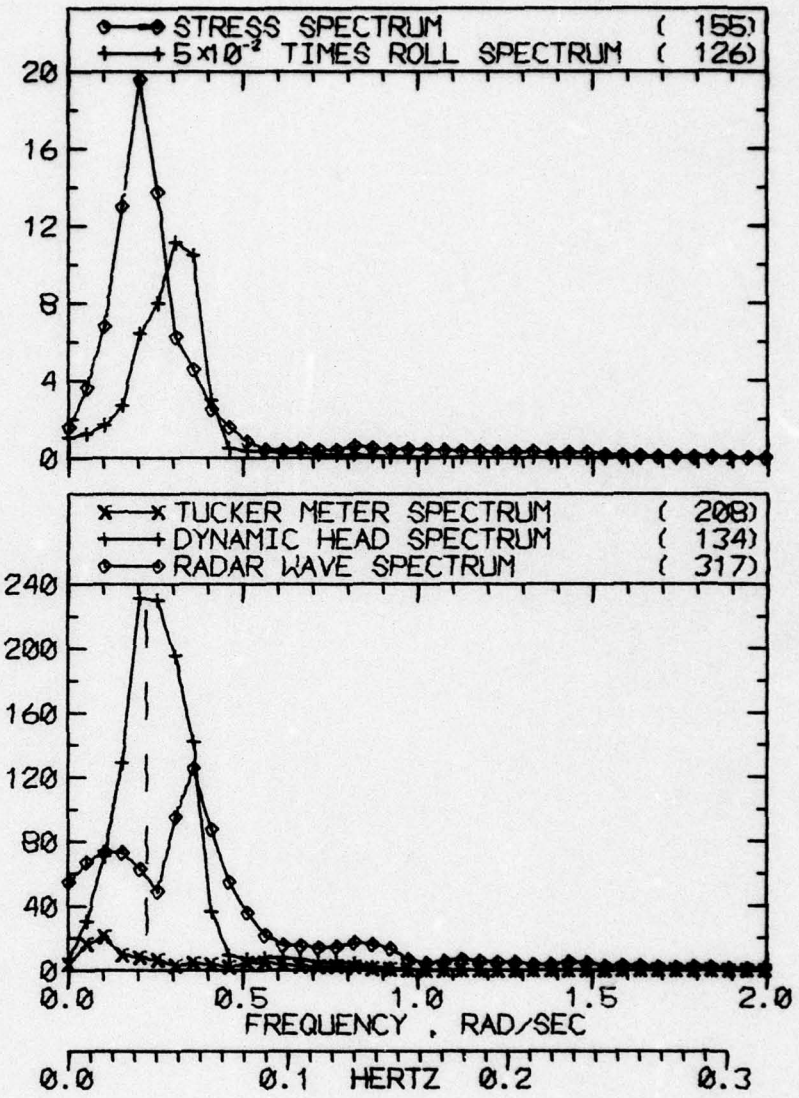
MAXIMUM PK-TR	9.7 KPSI
4.0 X RMS	8.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

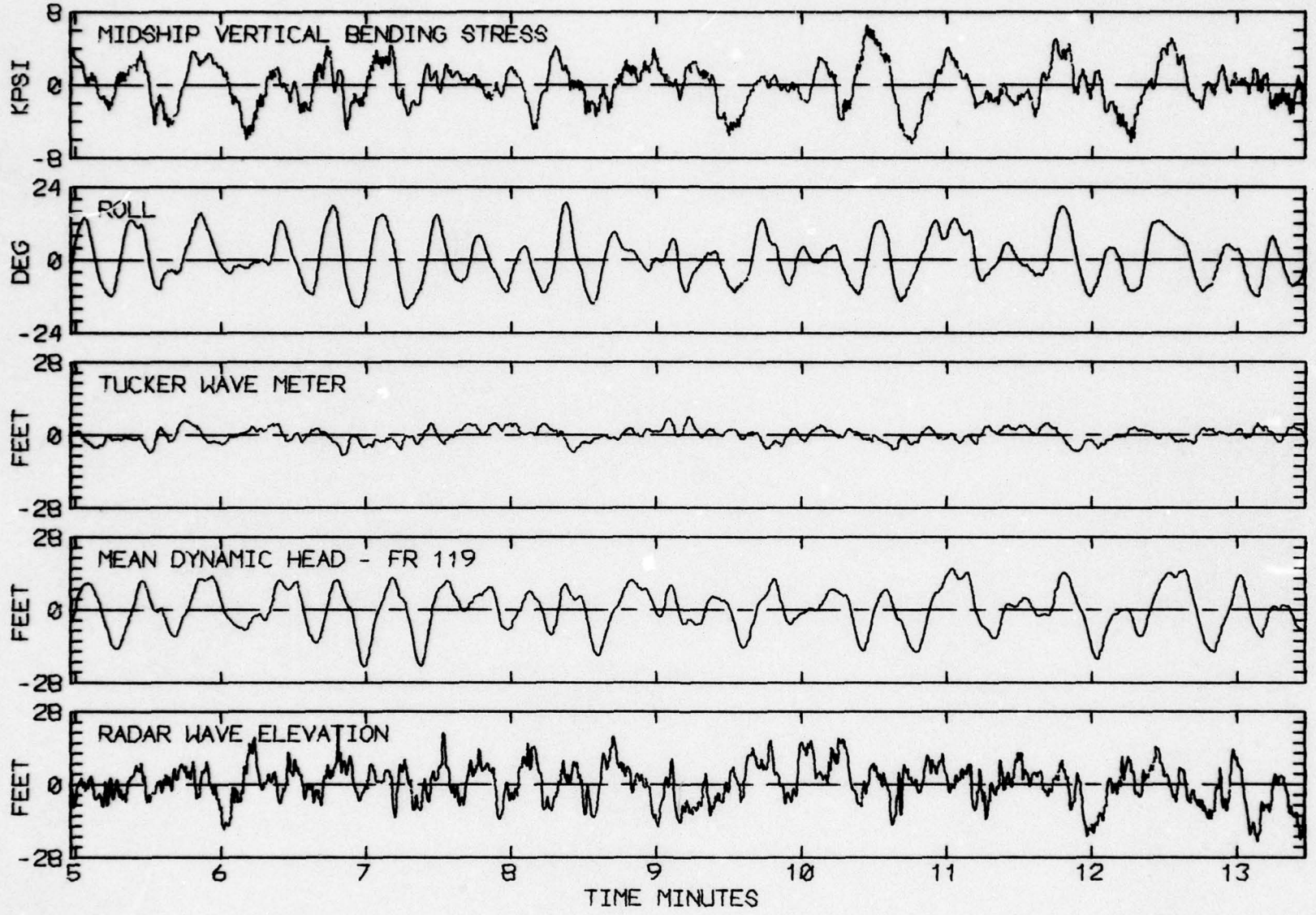
ROLL	28.0 DEG
PITCH	1.08 DEG
DK HSE VERT ACCEL	0.27 G
DK HSE LAT ACCEL	0.63 G
RADAR SLANT RANGE	36.0 FEET
VERTICAL RANGE	29.2 FEET
DISPL AT RADAR	30.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	104	51	144
MAXIMUM HEIGHT	11.1	35.5	35.1
10TH HIGHEST HTS	8.7	33.4	26.9
3RD HIGHEST HTS	6.7	27.9	20.7
4.0 RMS(SPECTRA)	9.3	30.4	28.6



RUN 621 -- VOYAGE 33E -- TAPE 149 -- INDEX 6 -- INTERVAL 21



RUN 621 -- VOYAGE 33E -- TAPE 149 -- INDEX 6 -- INTERVAL 21

LOG BOOK DATA

DATE AND TIME	01-18-74 1600
POSITION	42-17 N 55-25 W
COURSE AND SPEED	078 . 32.4 KNOTS
SEA STATE	8
WAVE HEIGHT	20 FEET
" REL DIR	78 PORT
SWELL HEIGHT	12 FEET
" REL DIR	78 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

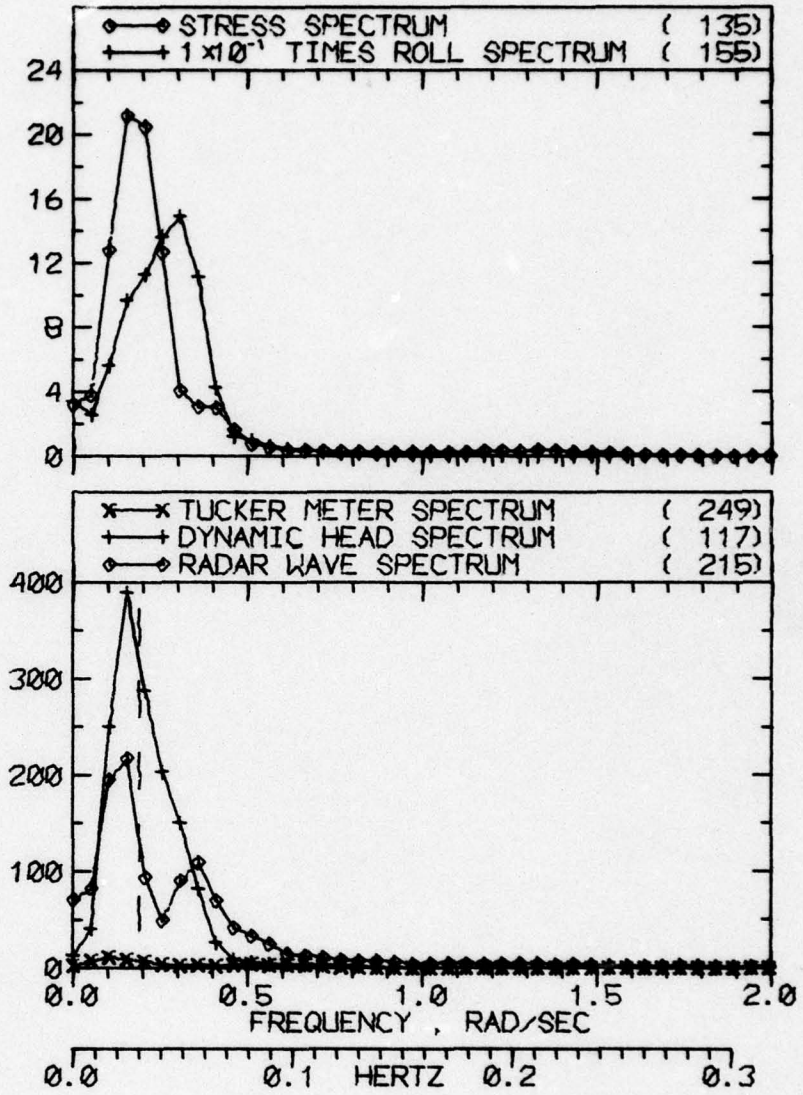
MAXIMUM PK-TR	10.1 KPSI
4.0 X RMS	8.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

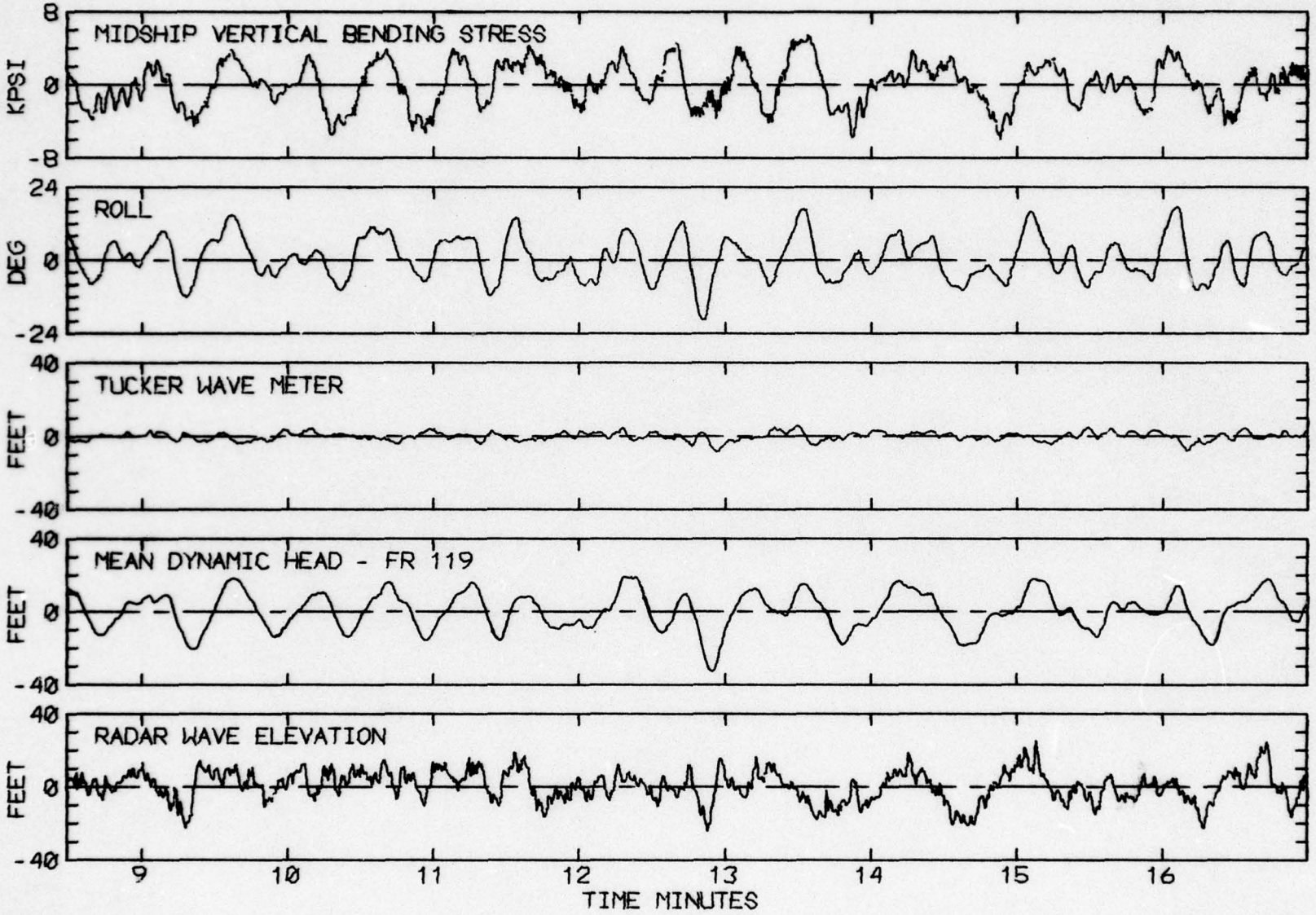
ROLL	25.5 DEG
PITCH	0.98 DEG
DK HSE VERT ACCEL	0.21 G
DK HSE LAT ACCEL	0.55 G
RADAR SLANT RANGE	35.9 FEET
VERTICAL RANGE	29.7 FEET
DISPL AT RADAR	30.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	142	36	109
MAXIMUM HEIGHT	11.0	42.2	37.6
10TH HIGHEST HTS	7.5	35.0	30.7
3RD HIGHEST HTS	5.2	31.7	23.0
4.0 RMS(SPECTRA)	7.7	34.7	31.5



RUN 625 -- VOYAGE 33E -- TAPE 149 -- INDEX 7 -- INTERVAL 25



RUN 625 -- VOYAGE 33E -- TAPE 149 -- INDEX 7 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	01-18-74 2000
POSITION	42-17 N 55-25 W
COURSE AND SPEED	078 . 32.3 KNOTS
SEA STATE	8
WAVE HEIGHT	20 FEET
" REL DIR	145 PORT
SWELL HEIGHT	12 FEET
" REL DIR	123 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /SHIPPING WATER OVER BOW

MIDSHIP VERTICAL BENDING STRESS

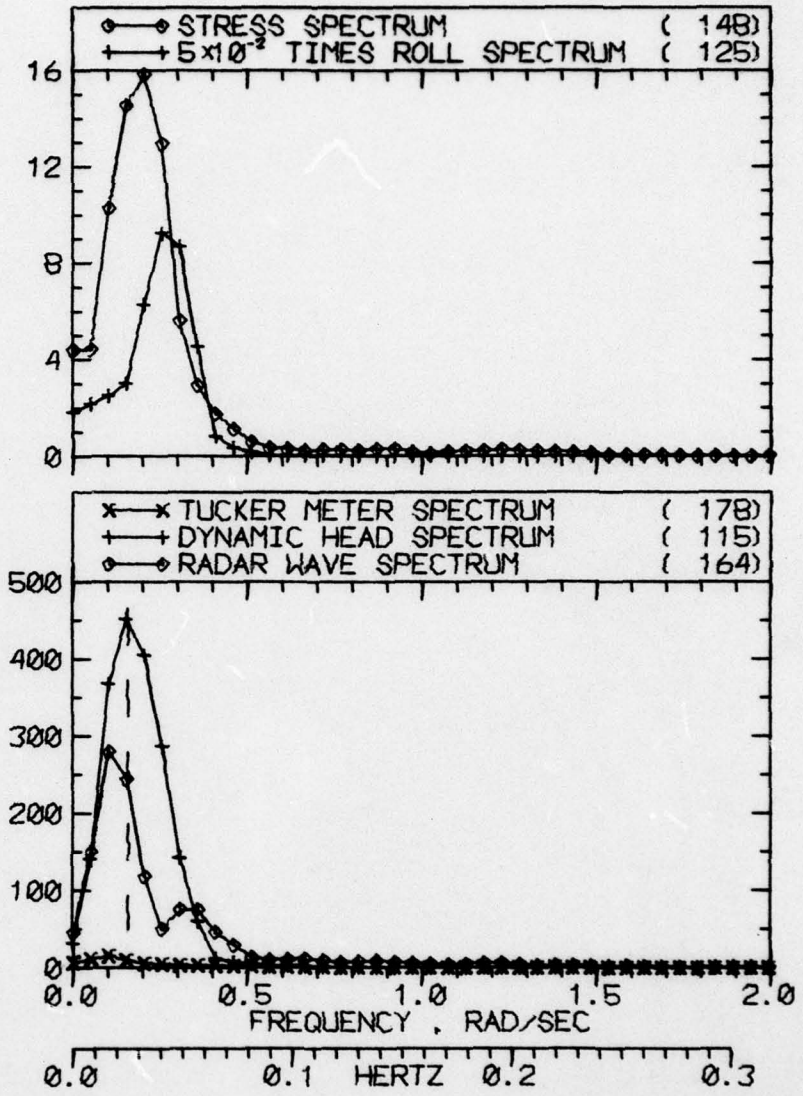
MAXIMUM PK-TR	10.3 KPSI
4.0 X RMS	8.0 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

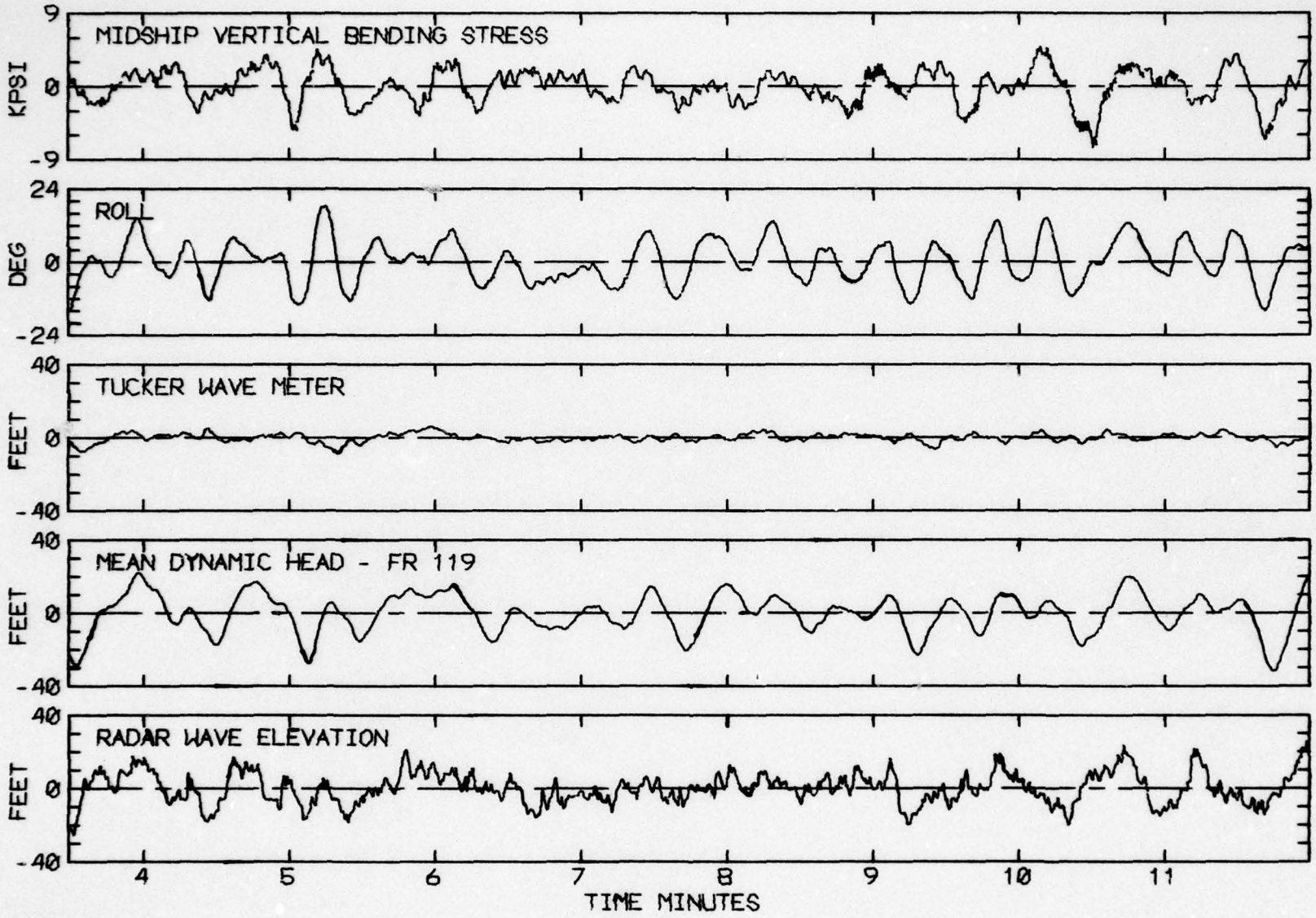
ROLL	25.3 DEG
PITCH	0.83 DEG
DK HSE VERT ACCEL	0.15 G
DK HSE LAT ACCEL	0.55 G
RADAR SLANT RANGE	33.7 FEET
VERTICAL RANGE	27.6 FEET
DISPL AT RADAR	31.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	129	34	124
MAXIMUM HEIGHT	11.3	44.3	38.3
10TH HIGHEST HTS	7.0	39.6	28.7
3RD HIGHEST HTS	4.4	34.9	20.1
4.0 RMS(SPECTRA)	7.7	39.5	32.2



RUN 629 -- VOYAGE 33E -- TAPE 149 -- INDEX 8 -- INTERVAL 29



RUN 629 -- VOYAGE 33E -- TAPE 149 -- INDEX 8 -- INTERVAL 29

LOG BOOK DATA

DATE AND TIME	01-18-74 2400
POSITION	42-17 N 55-25 W
COURSE AND SPEED	078 . 32.4 KNOTS
SEA STATE	8
WAVE HEIGHT	20 FEET
" REL DIR	123 PORT
SWELL HEIGHT	12 FEET
" REL DIR	123 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

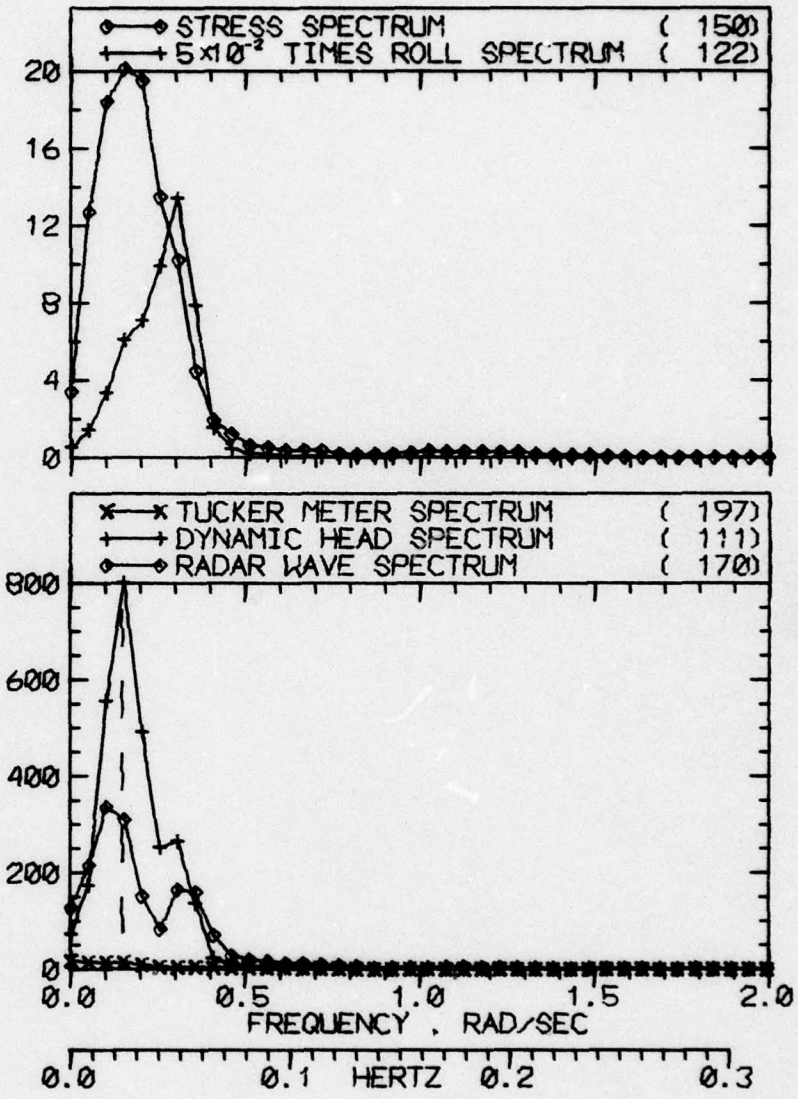
MAXIMUM PK-TR	12.9 KPSI
4.0 X RMS	9.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

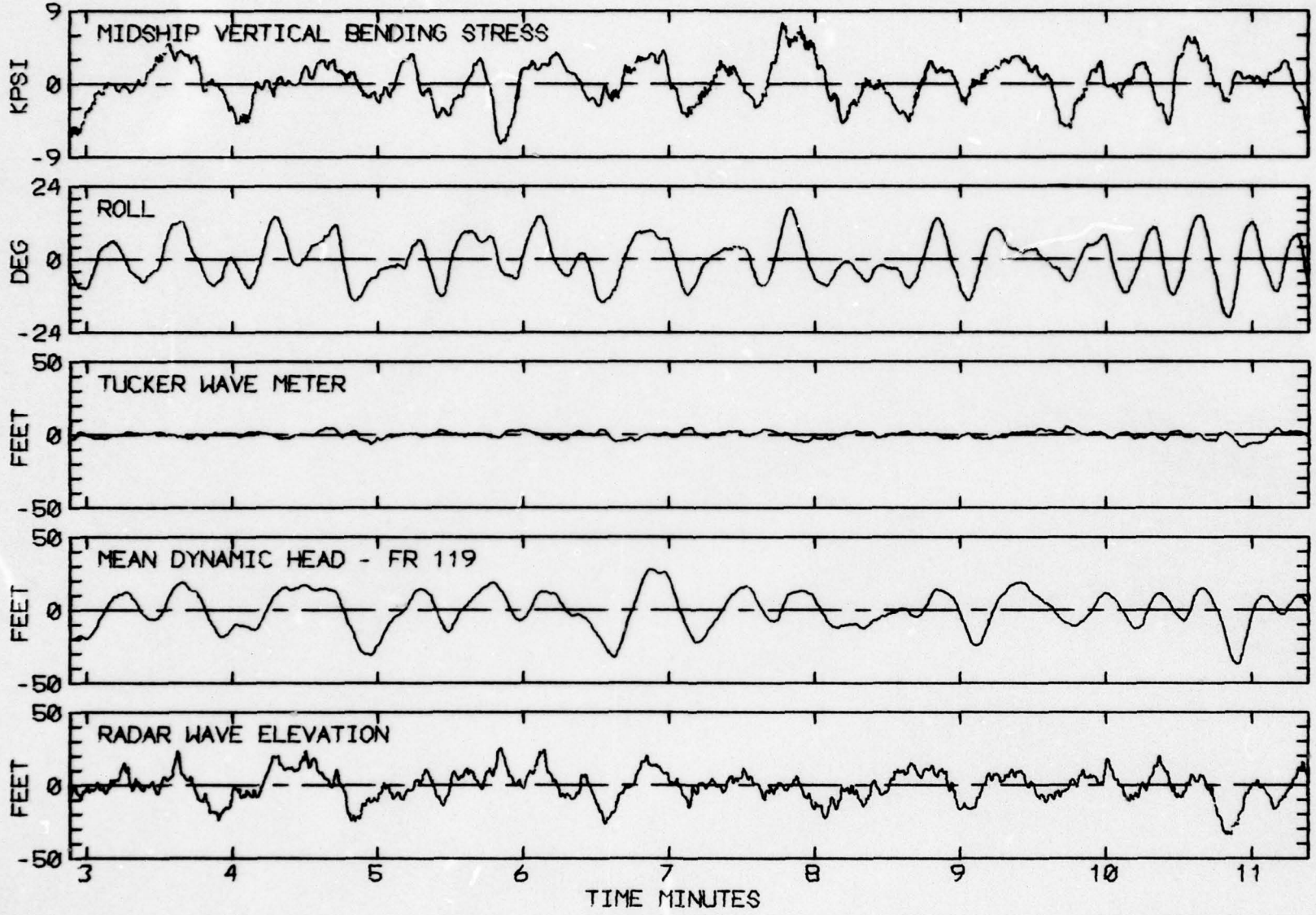
ROLL	29.2 DEG
PITCH	0.97 DEG
DK HSE VERT ACCEL	0.16 G
DK HSE LAT ACCEL	0.68 G
RADAR SLANT RANGE	39.5 FEET
VERTICAL RANGE	29.5 FEET
DISPL AT RADAR	38.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	113	38	90
MAXIMUM HEIGHT	10.1	52.1	47.4
10TH HIGHEST HTS	8.1	48.3	35.5
3RD HIGHEST HTS	5.5	38.9	25.3
4.0 RMS(SPECTRA)	8.9	47.6	37.7



RUN 633 -- VOYAGE 33E -- TAPE 149 -- INDEX 9 -- INTERVAL 33



RUN 633 -- VOYAGE 33E -- TAPE 149 -- INDEX 9 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	01-19-74 0400
POSITION	42-17 N 55-25 W
COURSE AND SPEED	077 . 32.5 KNOTS
SEA STATE	9
WAVE HEIGHT	20 FEET
" REL DIR	122 PORT
SWELL HEIGHT	15 FEET
" REL DIR	122 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

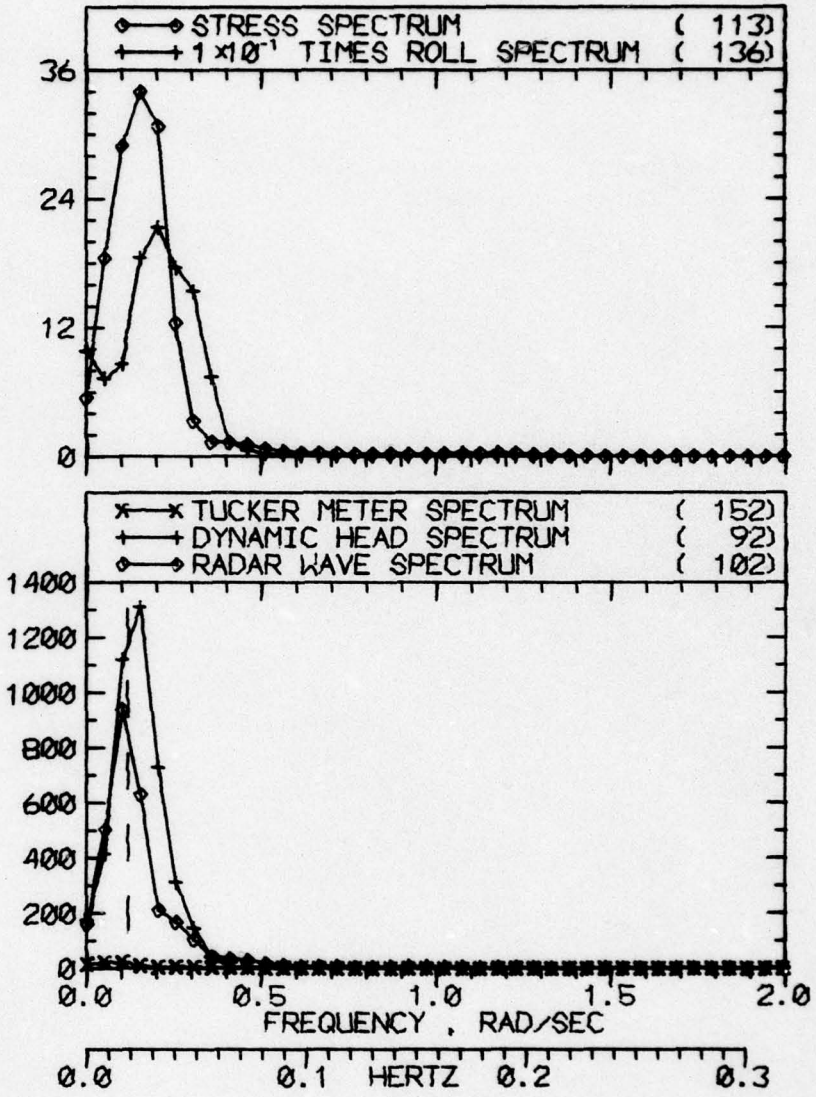
MAXIMUM PK-TR	13.8 KPSI
4.0 X RMS	10.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

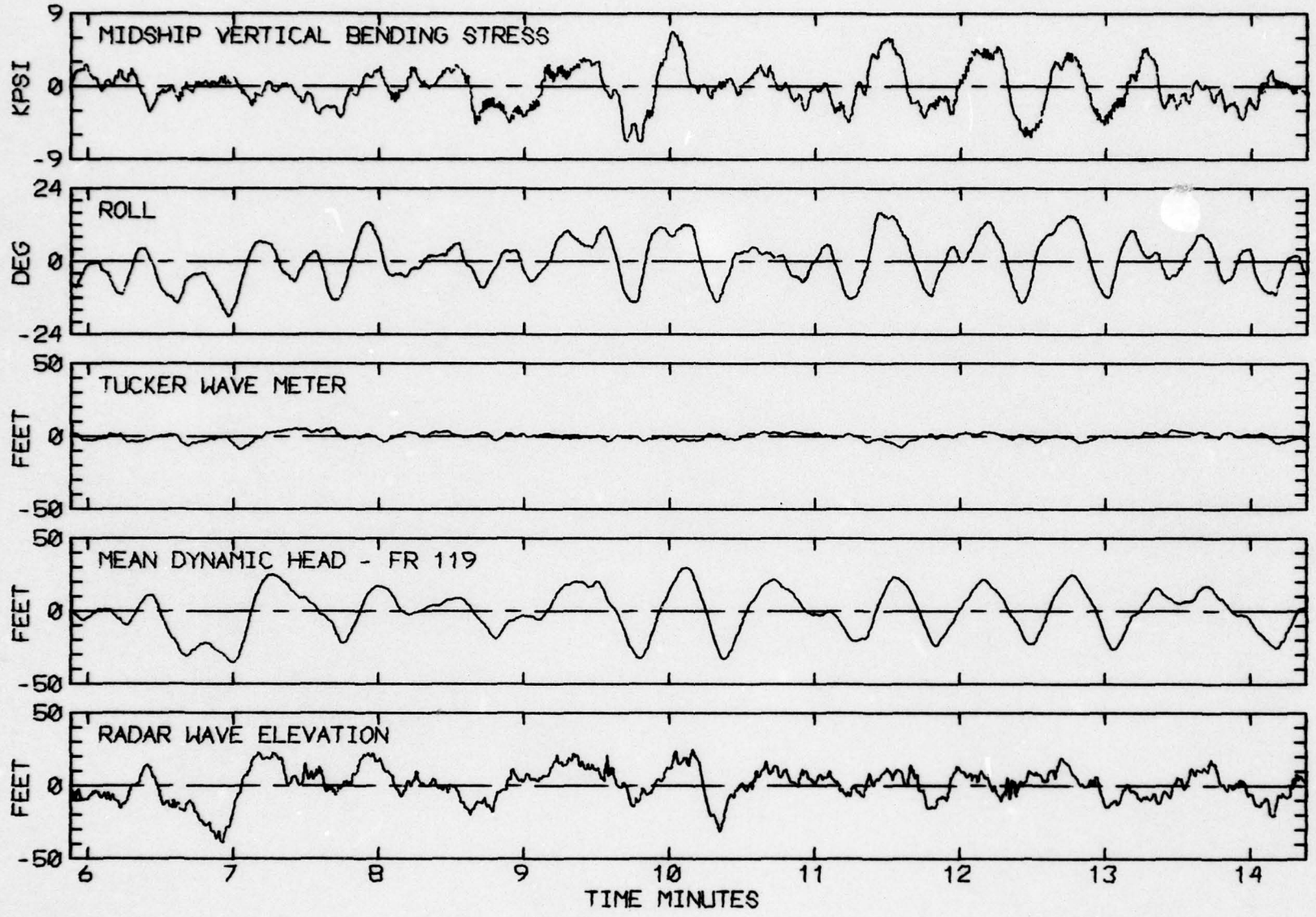
ROLL	29.1 DEG
PITCH	1.05 DEG
DK HSE VERT ACCEL	0.16 G
DK HSE LAT ACCEL	0.63 G
RADAR SLANT RANGE	44.1 FEET
VERTICAL RANGE	32.6 FEET
DISPL AT RADAR	45.9 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN. HEAD/RADAR	
P-T SAMPLE SIZE	113	29	67
MAXIMUM HEIGHT	9.9	62.6	55.8
10TH HIGHEST HTS	7.8	55.0	44.4
3RD HIGHEST HTS	5.3	49.2	30.4
4.0 RMS(SPECTRA)	9.3	58.5	48.7



RUN 637 -- VOYAGE 33E -- TAPE 149 -- INDEX 10 -- INTERVAL 37



RUN 637 -- VOYAGE 33E -- TAPE 149 -- INDEX 10 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	01-19-74 0800
POSITION	42-17 N 55-25 W
COURSE AND SPEED	077 , 32.5 KNOTS
SEA STATE	8
WAVE HEIGHT	20 FEET
" REL DIR	122 PORT
SWELL HEIGHT	15 FEET
" REL DIR	122 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

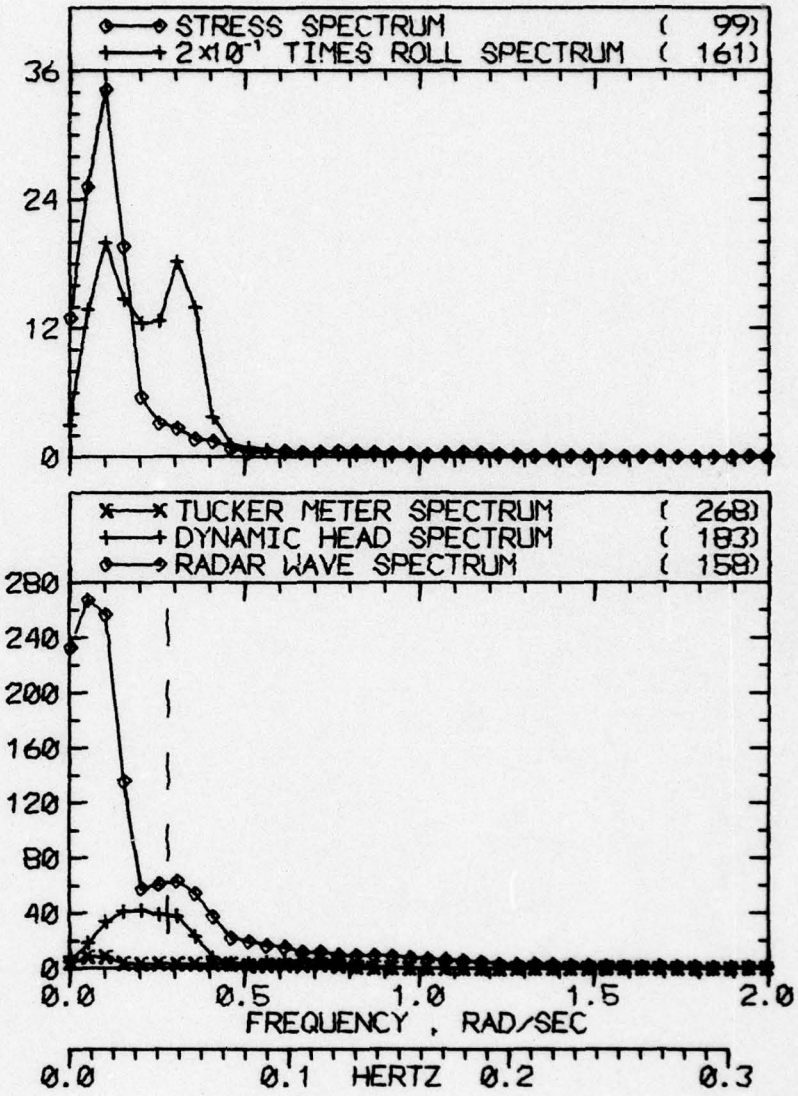
MAXIMUM PK-TR	9.7 KPSI
4.0 X RMS	9.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

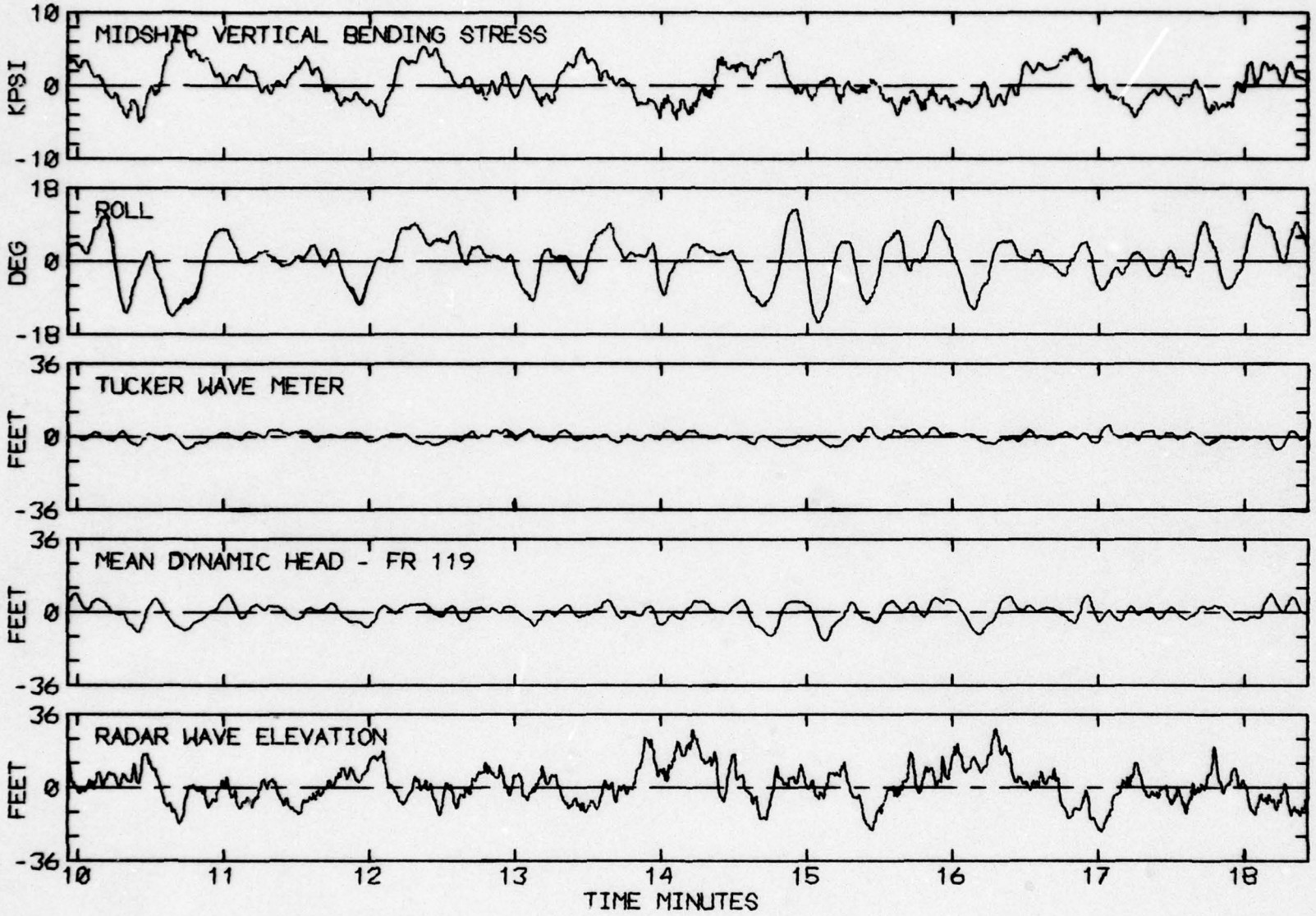
ROLL	21.7 DEG
PITCH	1.04 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.46 G
RADAR SLANT RANGE	42.4 FEET
VERTICAL RANGE	33.4 FEET
DISPL AT RADAR	17.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	161	74	101
MAXIMUM HEIGHT	7.0	19.6	35.4
10TH HIGHEST HTS	5.8	15.9	29.4
3RD HIGHEST HTS	4.4	11.5	21.4
4.0 RMS(SPECTRA)	6.9	15.2	32.1



RUN 641 -- VOYAGE 33E -- TAPE 149 -- INDEX 11 -- INTERVAL 41



RUN 641 -- VOYAGE 33E -- TAPE 149 -- INDEX 11 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	01-19-74 1100
POSITION	42-17 N 55-25 W
COURSE AND SPEED	077 . 32.2 KNOTS
SEA STATE	9
WAVE HEIGHT	20 FEET
" REL DIR	144 PORT
SWELL HEIGHT	15 FEET
" REL DIR	144 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

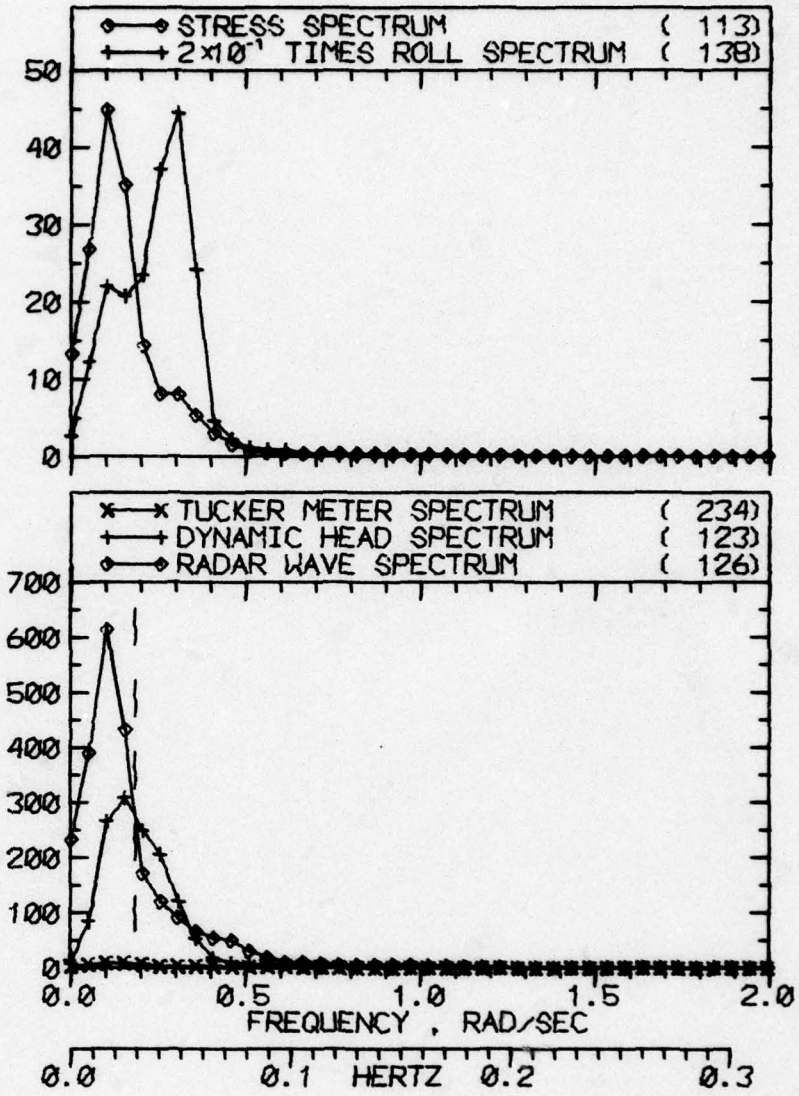
MAXIMUM PK-TR	14.5 KPSI
4.0 X RMS	11.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

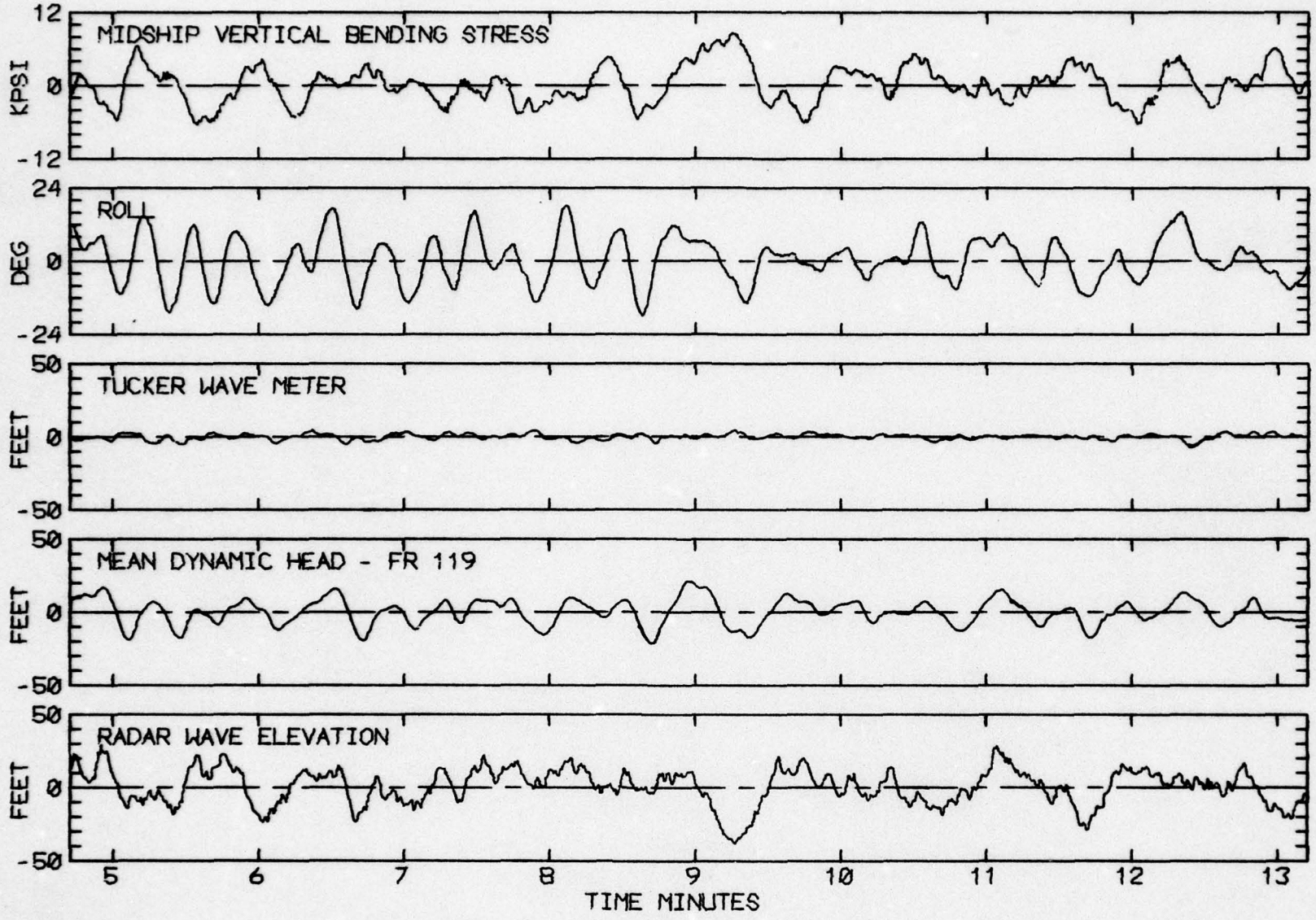
ROLL	28.4 DEG
PITCH	1.03 DEG
DK HSE VERT ACCEL	0.20 G
DK HSE LAT ACCEL	0.61 G
RADAR SLANT RANGE	52.4 FEET
VERTICAL RANGE	37.2 FEET
DISPL AT RADAR	28.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	121	40	69
MAXIMUM HEIGHT	10.3	38.1	49.3
10TH HIGHEST HTS	7.0	35.7	41.6
3RD HIGHEST HTS	4.9	29.1	29.8
4.0 RMS(SPECTRA)	7.1	33.3	43.0



RUN 645 -- VOYAGE 33E -- TAPE 149 -- INDEX 12 -- INTERVAL 45



RUN 645 -- VOYAGE 33E -- TAPE 149 -- INDEX 12 -- INTERVAL 45

LOG BOOK DATA

DATE AND TIME	01-19-74 1310
POSITION	44-30 N 39-55 W
COURSE AND SPEED	077 . 32.2 KNOTS
SEA STATE	9
WAVE HEIGHT	20 FEET
" REL DIR	144 PORT
SWELL HEIGHT	15 FEET
" REL DIR	144 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /SAW 33 DEG ROLL

MIDSHIP VERTICAL BENDING STRESS

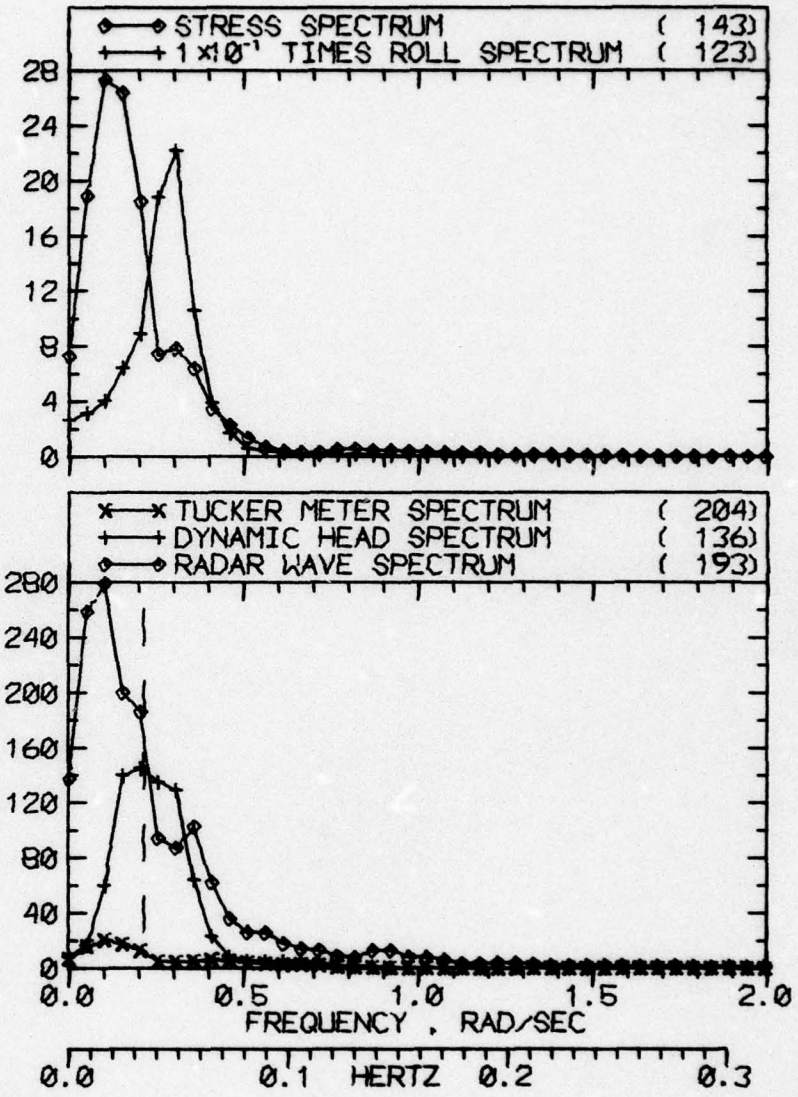
MAXIMUM PK-TR	11.4 KPSI
4.0 X RMS	10.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

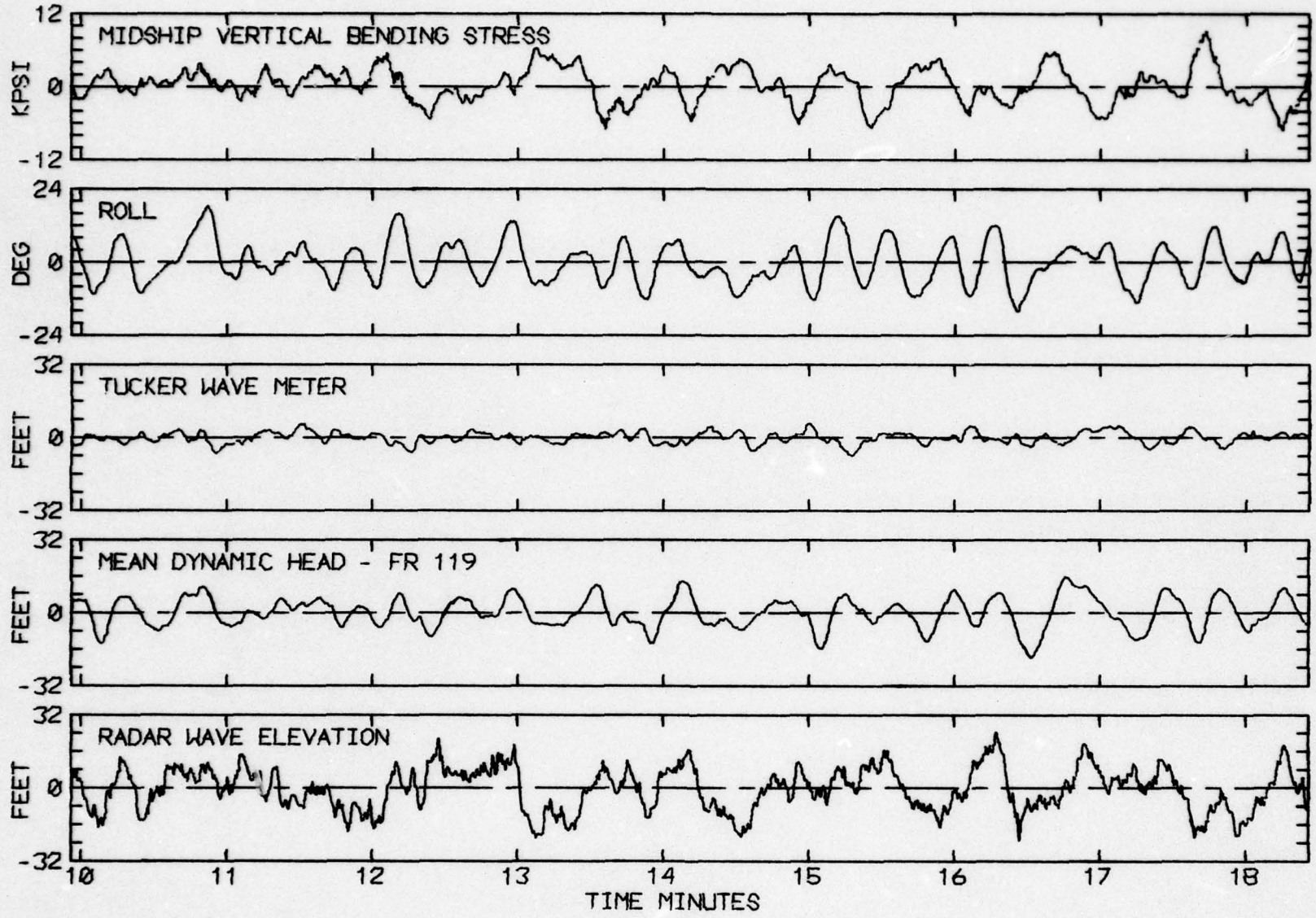
ROLL	26.1 DEG
PITCH	0.95 DEG
DK HSE VERT ACCEL	0.21 G
DK HSE LAT ACCEL	0.60 G
RADAR SLANT RANGE	48.1 FEET
VERTICAL RANGE	35.3 FEET
DISPL AT RADAR	25.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	103	45	88
MAXIMUM HEIGHT	13.1	28.2	47.0
10TH HIGHEST HTS	9.2	26.5	37.5
3RD HIGHEST HTS	6.9	22.8	26.6
4.0 RMS(SPECTRA)	9.9	24.9	36.2



RUN 649 -- VOYAGE 33E -- TAPE 149 -- INDEX 13 -- INTERVAL 49



RUN 649 -- VOYAGE 33E -- TAPE 149 -- INDEX 13 -- INTERVAL 49

LOG BOOK DATA

DATE AND TIME	01-19-74 1530
POSITION	44-30 N 39-55 W
COURSE AND SPEED	078 . 32.4 KNOTS
SEA STATE	10
WAVE HEIGHT	25 FEET
" REL DIR	145 PORT
SWELL HEIGHT	15 FEET
" REL DIR	145 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /MANUAL OPERATION

MIDSHIP VERTICAL BENDING STRESS

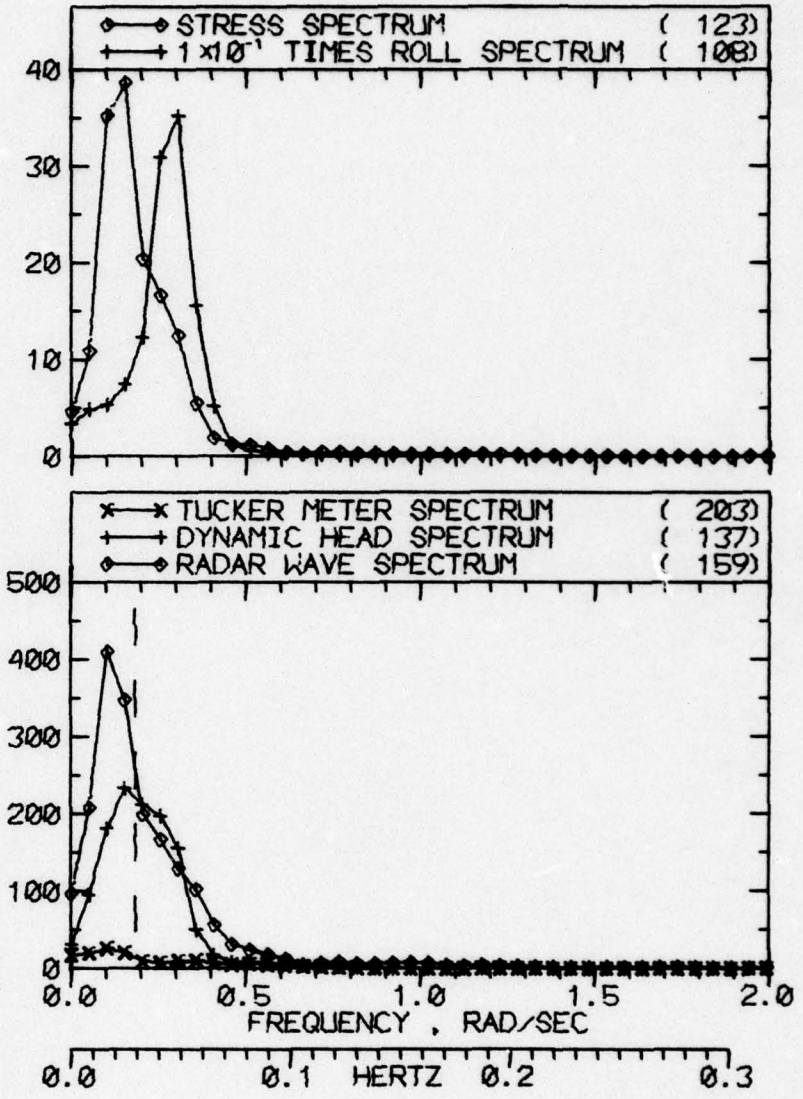
MAXIMUM PK-TR	17.6 KPSI
4.0 X RMS	11.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

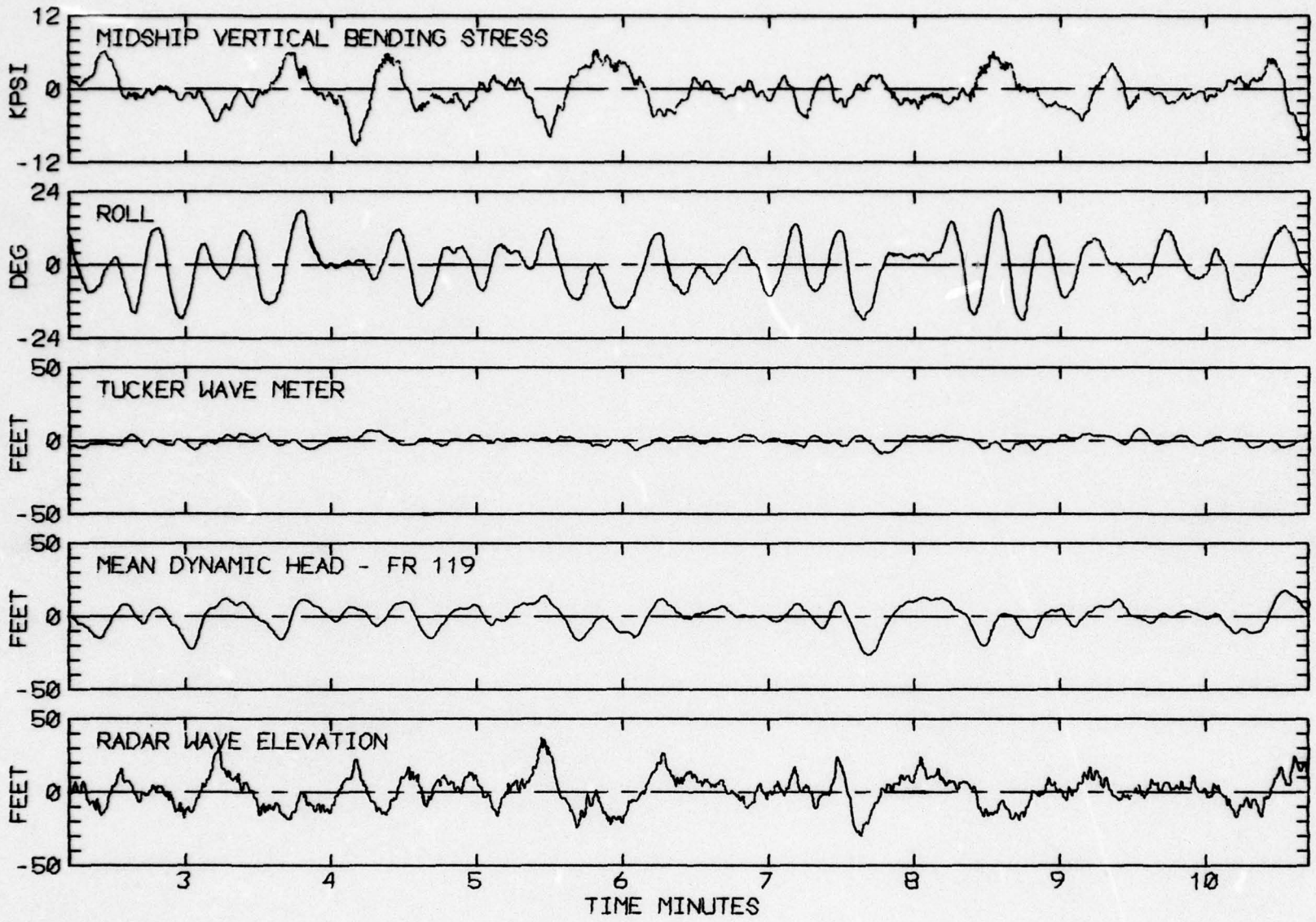
ROLL	31.6 DEG
PITCH	1.00 DEG
DK HSE VERT ACCEL	0.18 G
DK HSE LAT ACCEL	0.68 G
RADAR SLANT RANGE	55.8 FEET
VERTICAL RANGE	36.5 FEET
DISPL AT RADAR	28.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	87	52	85
MAXIMUM HEIGHT	12.6	36.4	60.8
10TH HIGHEST HTS	10.1	32.4	44.9
3RD HIGHEST HTS	7.8	26.8	29.3
4.0 RMS(SPECTRA)	10.9	31.3	39.1



RUN 653 -- VOYAGE 33E -- TAPE 149 -- INDEX 14 -- INTERVAL 53



RUN 653 -- VOYAGE 33E -- TAPE 149 -- INDEX 14 -- INTERVAL 53

LOG BOOK DATA

DATE AND TIME	01-19-74 1740
POSITION	44-30 N 39-55 W
COURSE AND SPEED	078 . 32.4 KNOTS
SEA STATE	10
WAVE HEIGHT	20 FEET
" REL DIR	145 PORT
SWELL HEIGHT	15 FEET
" REL DIR	145 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

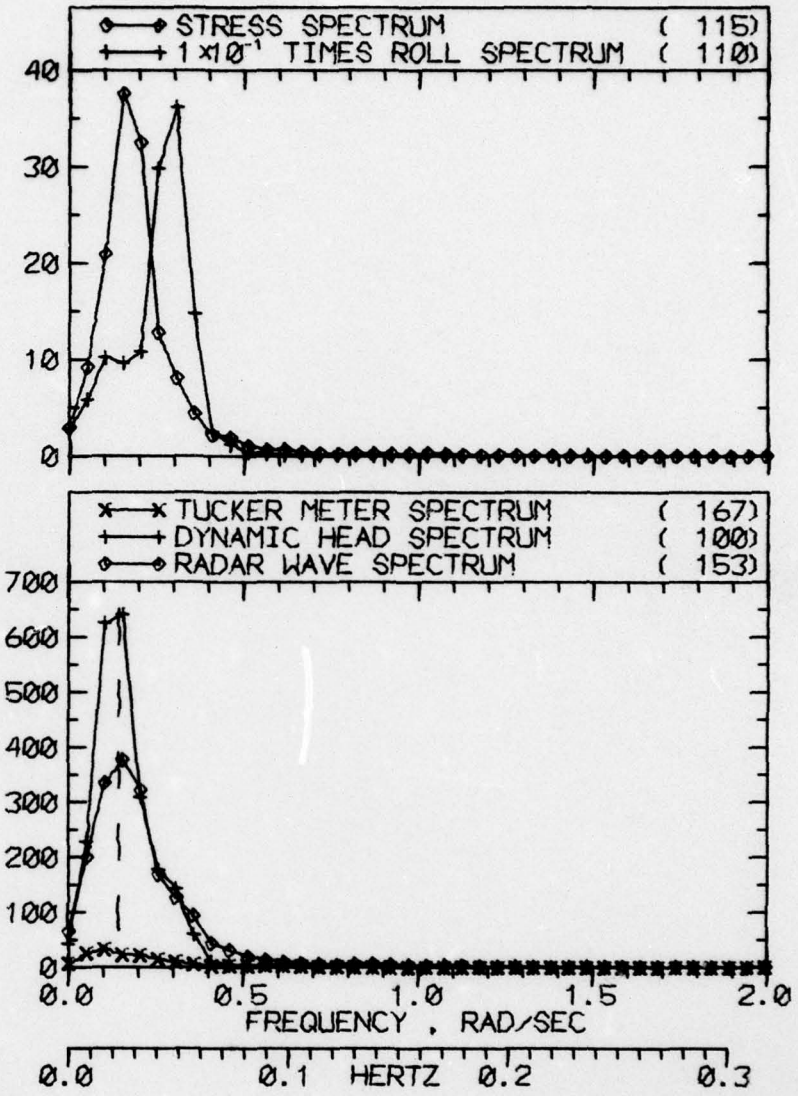
MAXIMUM PK-TR	13.0 KPSI
4.0 X RMS	10.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

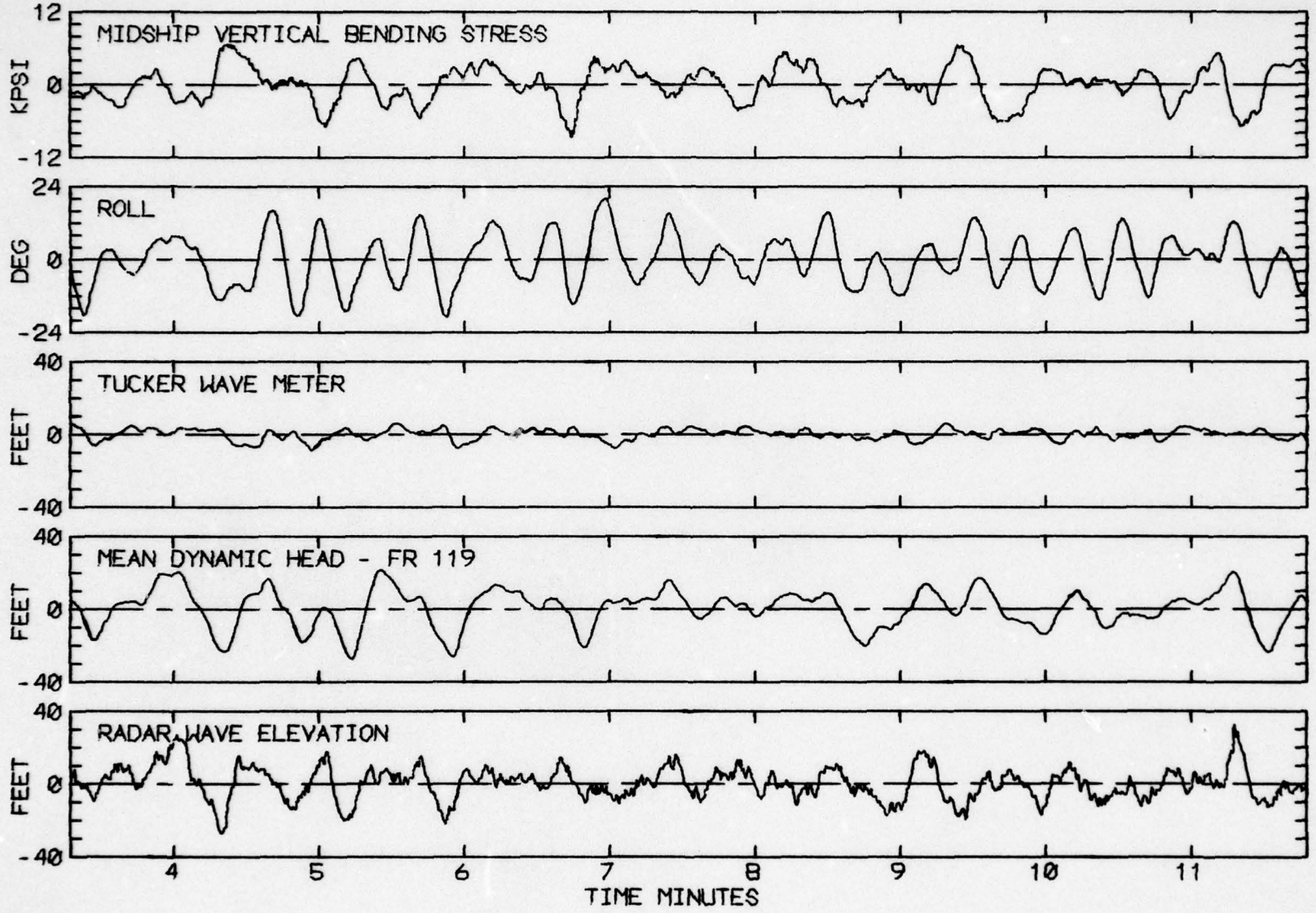
ROLL	31.8 DEG
PITCH	0.96 DEG
DK HSE VERT ACCEL	0.17 G
DK HSE LAT ACCEL	0.71 G
RADAR SLANT RANGE	53.2 FEET
VERTICAL RANGE	32.0 FEET
DISPL AT RADAR	35.7 FEET

WAVE HEIGHT STATISTICS (FEET)

		TUCKER/DYN.	HEAD/RADAR
P-T SAMPLE SIZE	87	26	101
MAXIMUM HEIGHT	13.6	58.1	47.2
10TH HIGHEST HTS	11.1	49.3	34.7
3RD HIGHEST HTS	7.9	40.4	23.9
4.0 RMS(SPECTRA)	11.6	42.9	39.2



RUN 657 -- VOYAGE 33E -- TAPE 149 -- INDEX 15 -- INTERVAL 57



RUN 657 -- VOYAGE 33E -- TAPE 149 -- INDEX 15 -- INTERVAL 57

LOG BOOK DATA

DATE AND TIME	01-19-74 2000
POSITION	44-30 N 39-55 W
COURSE AND SPEED	078 . 32.5 KNOTS
SEA STATE	7
WAVE HEIGHT	12 FEET
" REL DIR	145 PORT
SWELL HEIGHT	12 FEET
" REL DIR	145 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /BACK IN AUTO OPERATION

MIDSHIP VERTICAL BENDING STRESS

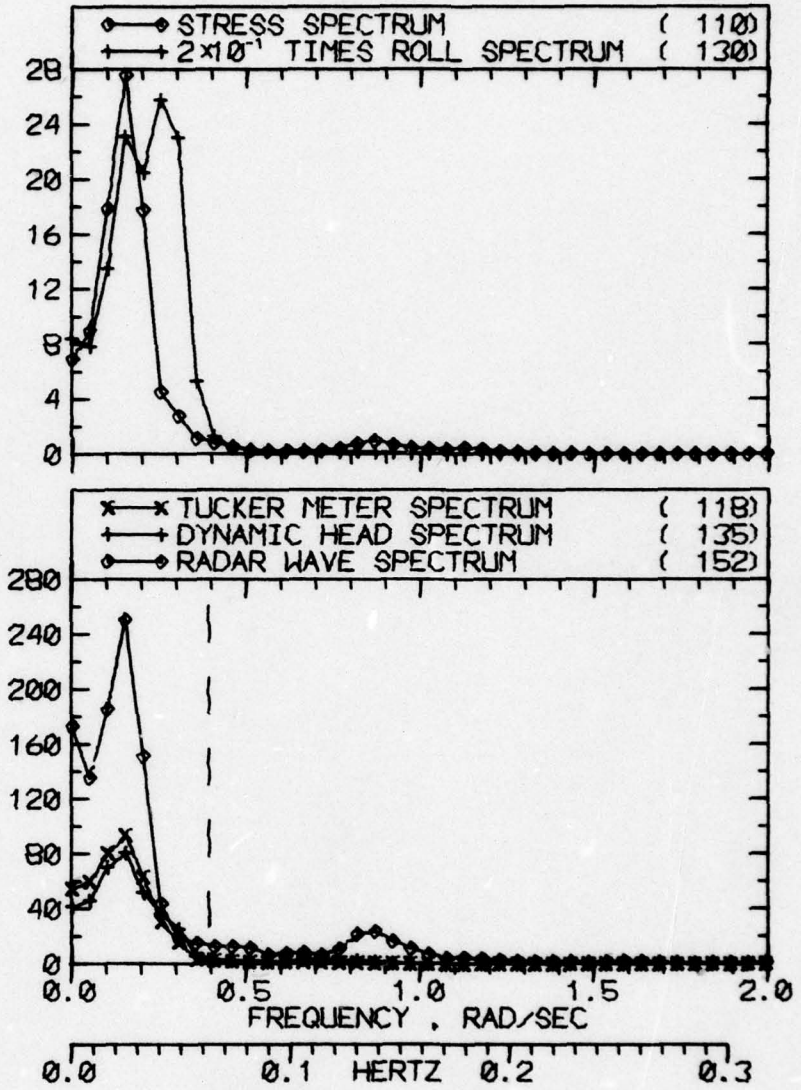
MAXIMUM PK-TR	9.0 KPSI
4.0 X RMS	8.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

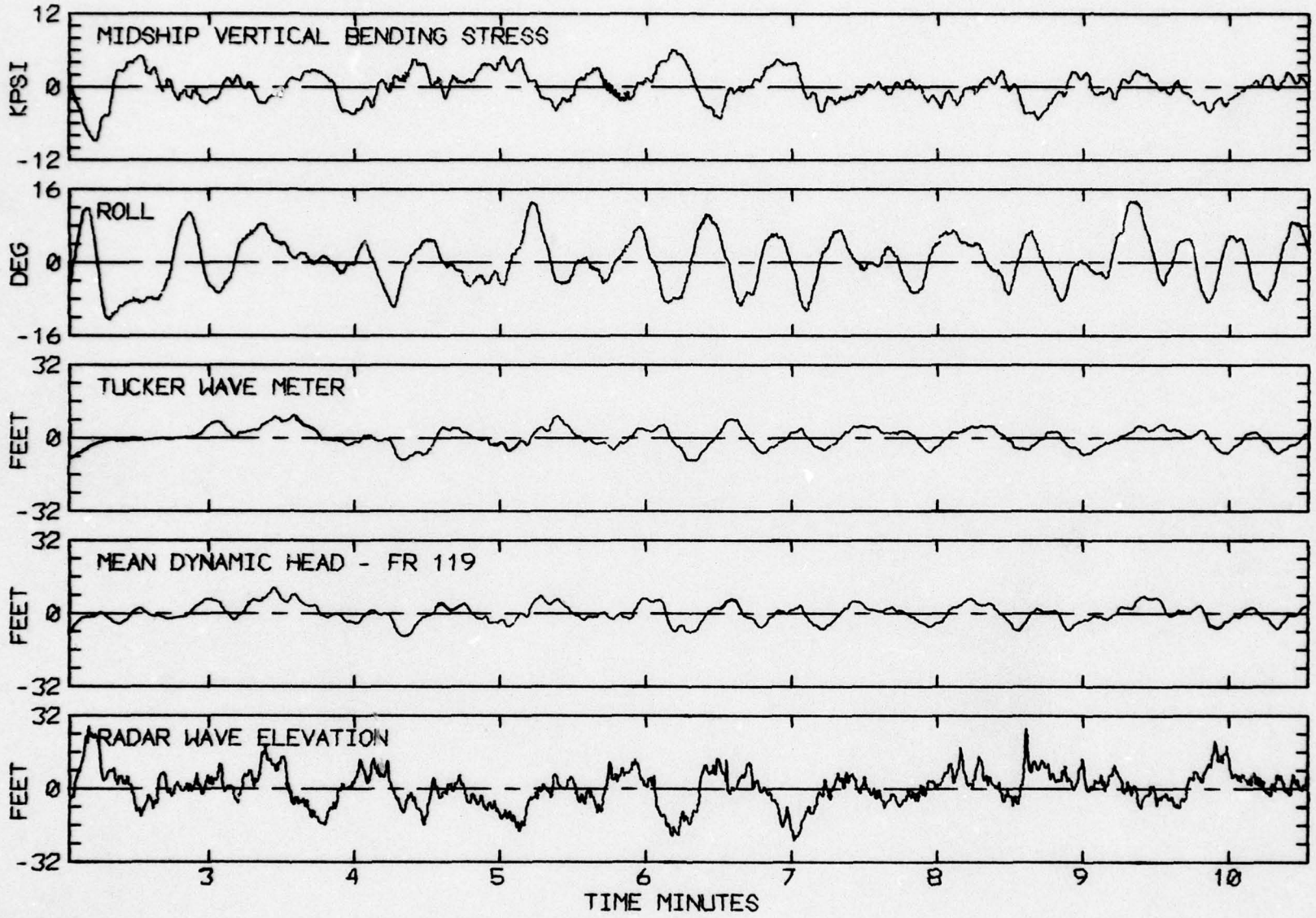
ROLL	22.8 DEG
PITCH	1.10 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.48 G
RADAR SLANT RANGE	50.5 FEET
VERTICAL RANGE	33.9 FEET
DISPL AT RADAR	12.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	31	41	122
MAXIMUM HEIGHT	17.9	17.2	39.1
10TH HIGHEST HTS	17.0	16.5	26.4
3RD HIGHEST HTS	15.7	13.8	18.3
4.0 RMS(SPECTRA)	17.8	17.1	30.0



RUN 702 -- VOYAGE 33E -- TAPE 151 -- INDEX 17 -- INTERVAL 2



RUN 702 -- VOYAGE 33E -- TAPE 151 -- INDEX 17 -- INTERVAL 2

LOG BOOK DATA

DATE AND TIME	01-19-74 2400
POSITION	44-30 N 39-55 W
COURSE AND SPEED	078 , 32.4 KNOTS
SEA STATE	6
WAVE HEIGHT	8 FEET
" REL DIR	145 PORT
SWELL HEIGHT	10 FEET
" REL DIR	145 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

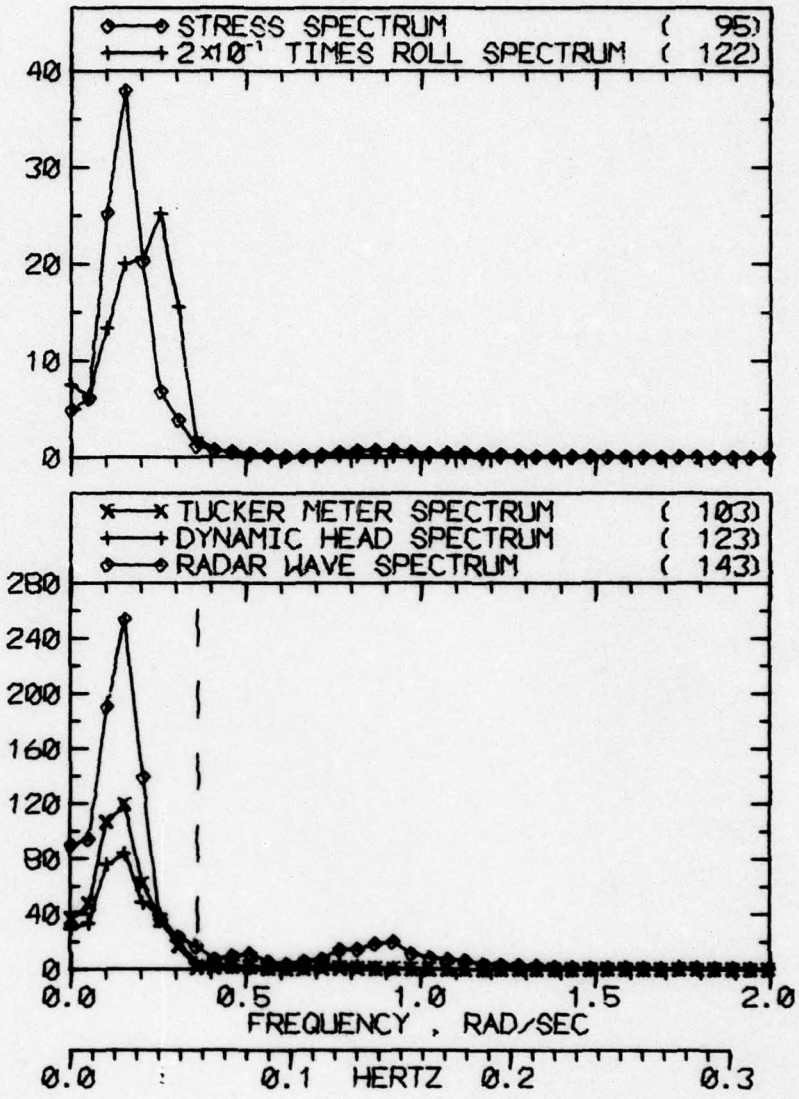
MAXIMUM PK-TR	12.3 KPSI
4.0 X RMS	9.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

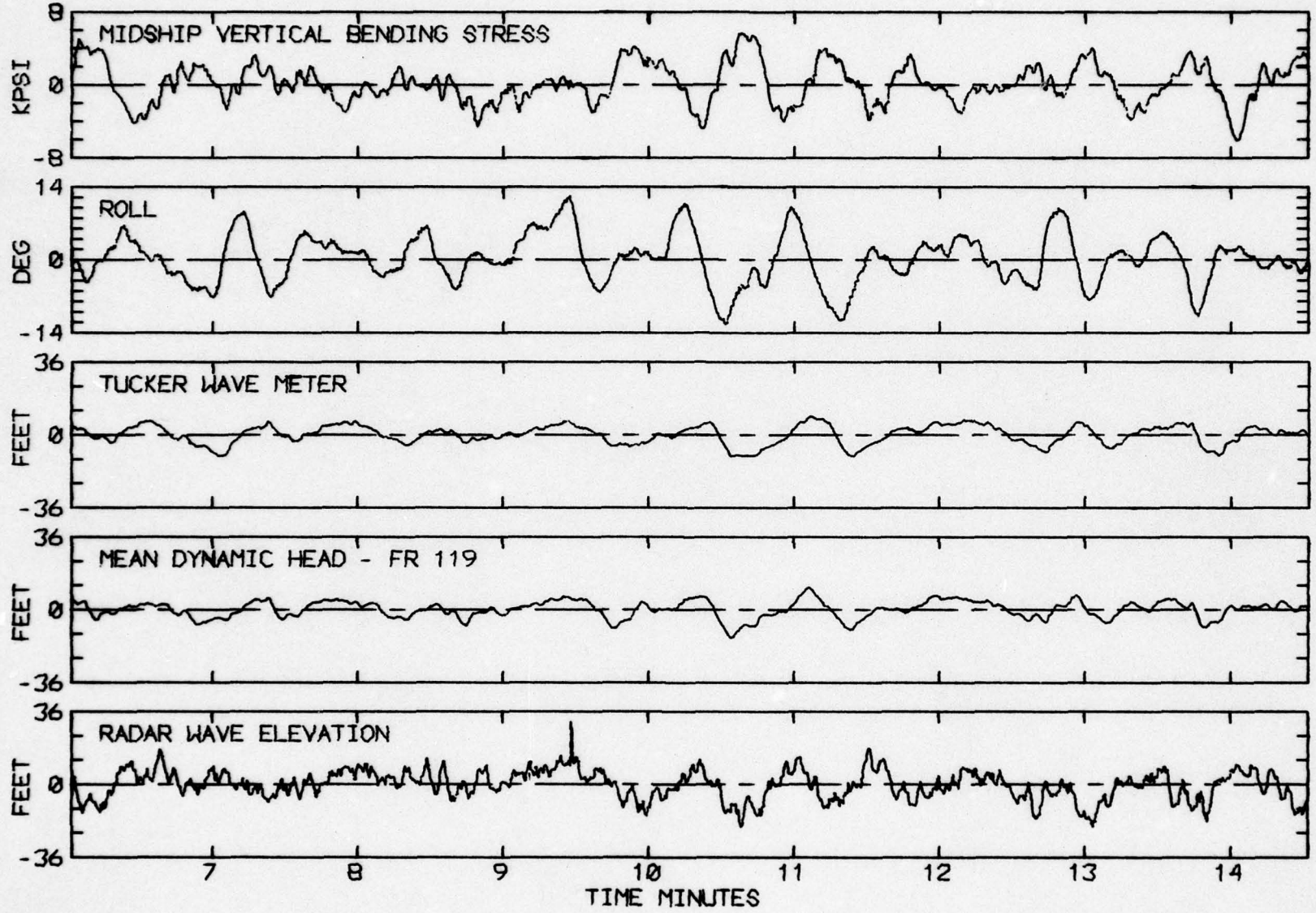
ROLL	21.1 DEG
PITCH	1.07 DEG
DK HSE VERT ACCEL	0.22 G
DK HSE LAT ACCEL	0.45 G
RADAR SLANT RANGE	49.4 FEET
VERTICAL RANGE	32.4 FEET
DISPL AT RADAR	12.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	33	48	123
MAXIMUM HEIGHT	19.4	20.5	31.6
10TH HIGHEST HTS	18.1	18.6	23.9
3RD HIGHEST HTS	16.6	14.4	18.1
4.0 RMS(SPECTRA)	18.5	16.7	28.5



RUN 705 -- VOYAGE 33E -- TAPE 151 -- INDEX 18 -- INTERVAL 5



RUN 705 -- VOYAGE 33E -- TAPE 151 -- INDEX 18 -- INTERVAL 5

LOG BOOK DATA

DATE AND TIME	01-20-74 0400
POSITION	44-30 N 39-55 W
COURSE AND SPEED	078 . 32.5 KNOTS
SEA STATE	6
WAVE HEIGHT	8 FEET
" REL DIR	123 PORT
SWELL HEIGHT	10 FEET
" REL DIR	145 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

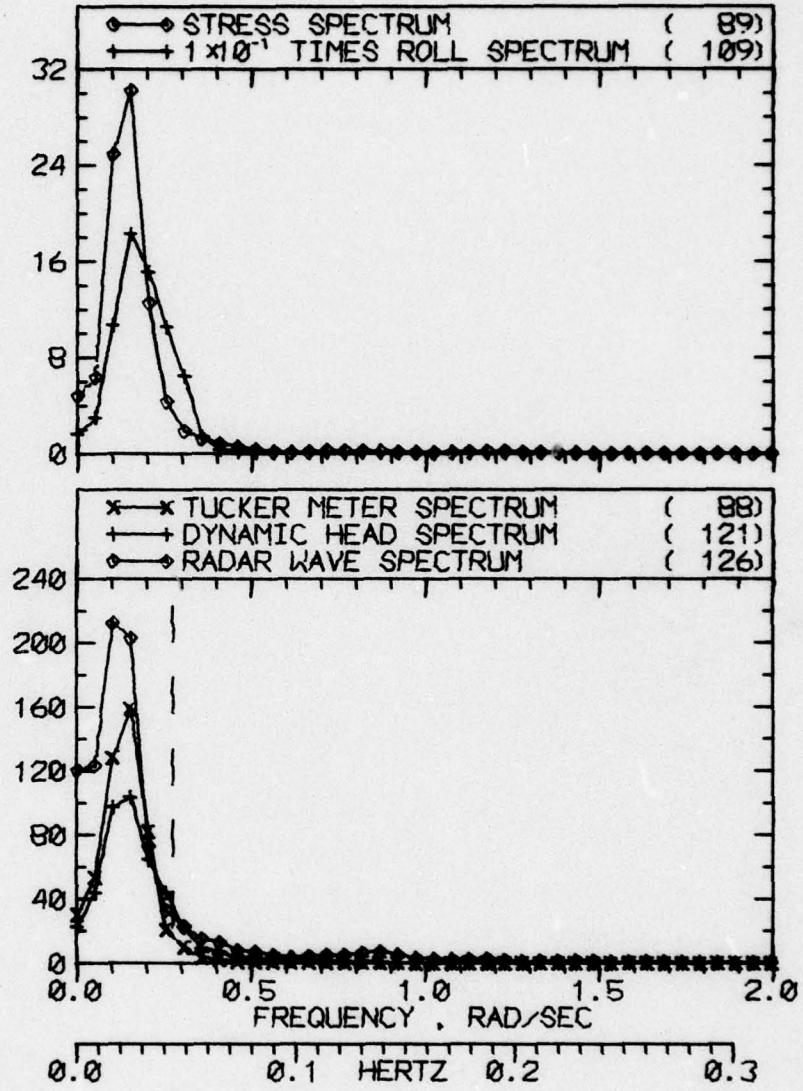
MAXIMUM PK-TR	9.3 KPSI
4.0 X RMS	8.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

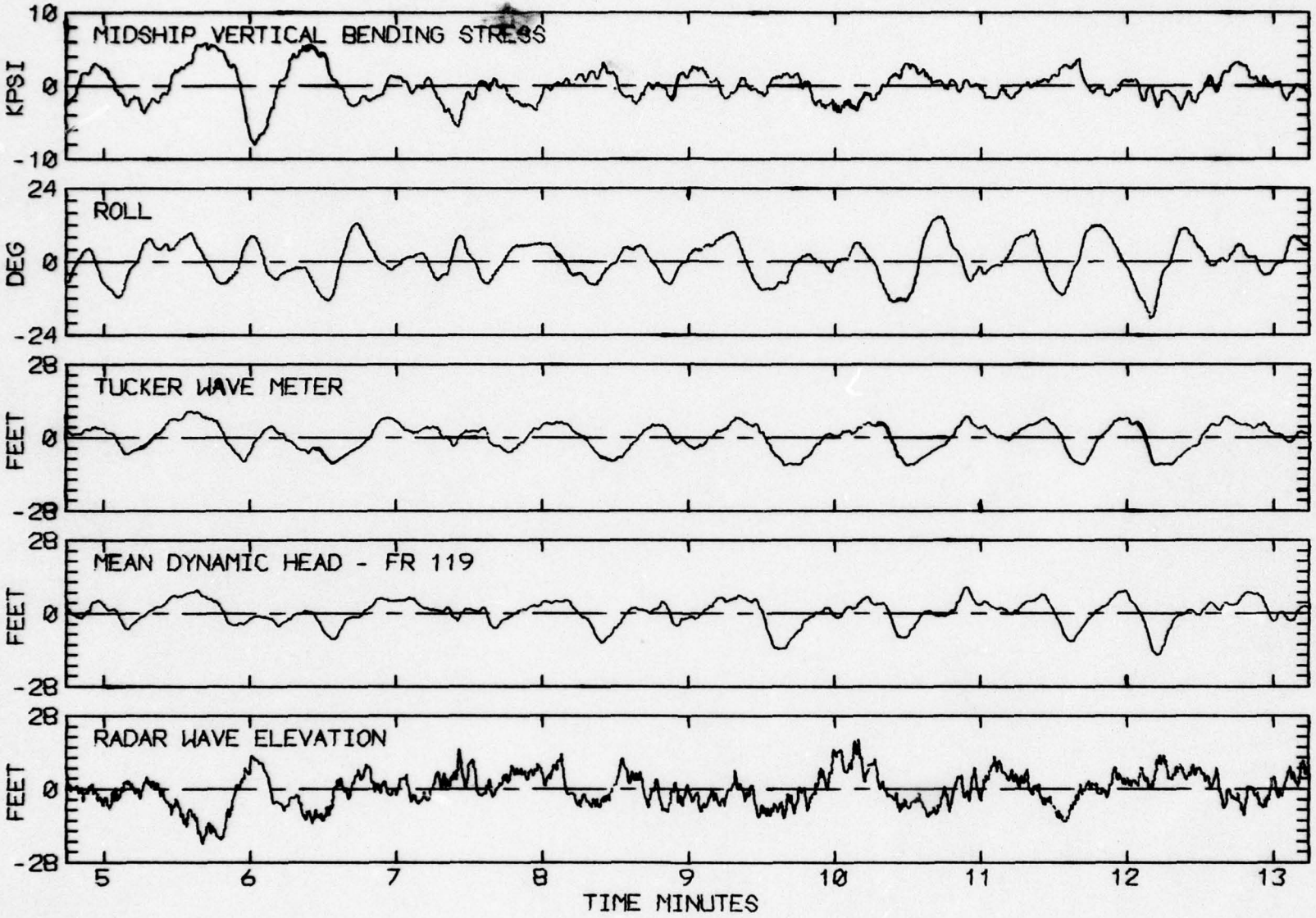
ROLL	23.6 DEG
PITCH	0.88 DEG
DK HSE VERT ACCEL	0.16 G
DK HSE LAT ACCEL	0.46 G
RADAR SLANT RANGE	48.8 FEET
VERTICAL RANGE	28.0 FEET
DISPL AT RADAR	11.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	29	46	103
MAXIMUM HEIGHT	19.2	24.5	26.8
10TH HIGHEST HTS	18.3	19.2	22.5
3RD HIGHEST HTS	15.9	14.7	16.1
4.0 RMS(SPECTRA)	19.9	18.6	26.5



RUN 709 -- VOYAGE 33E -- TAPE 151 -- INDEX 19 -- INTERVAL 9



RUN 709 -- VOYAGE 33E -- TAPE 151 -- INDEX 19 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	01-20-74 0800
POSITION	44-30 N 39-55 W
COURSE AND SPEED	078 . 32.6 KNOTS
SEA STATE	5
WAVE HEIGHT	4 FEET
" REL DIR	168 PORT
SWELL HEIGHT	10 FEET
" REL DIR	168 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

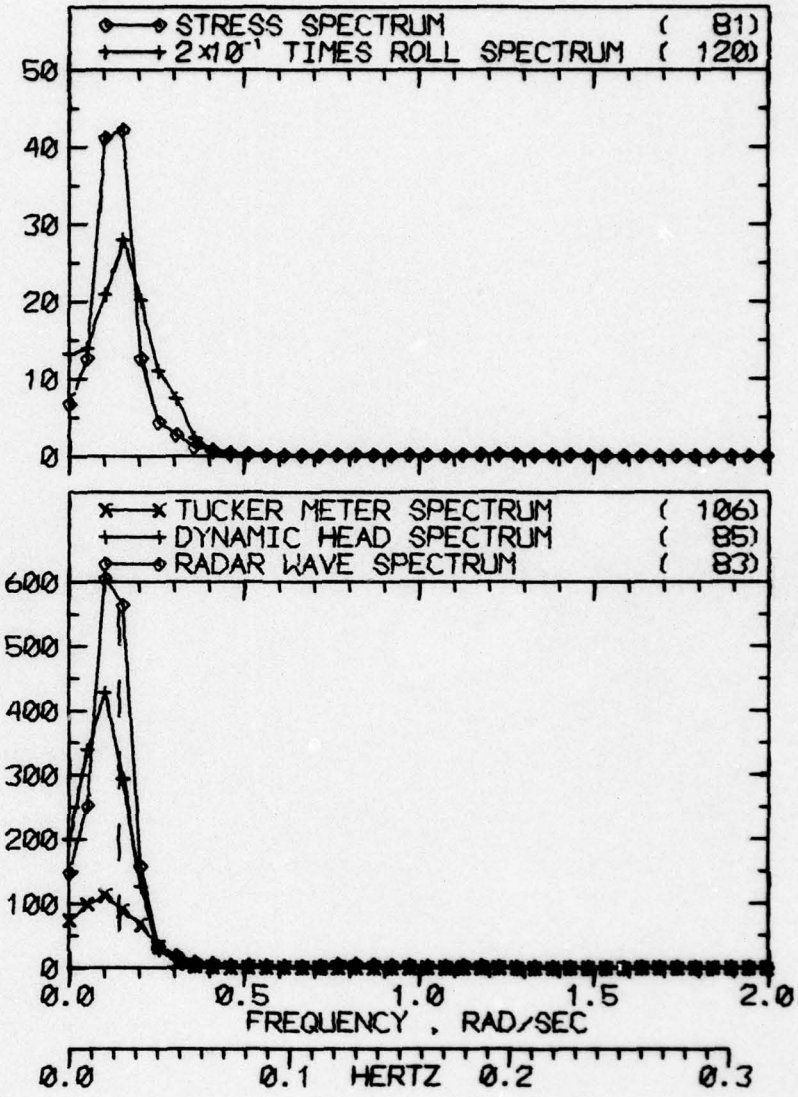
MAXIMUM PK-TR	13.7 KPSI
4.0 X RMS	10.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

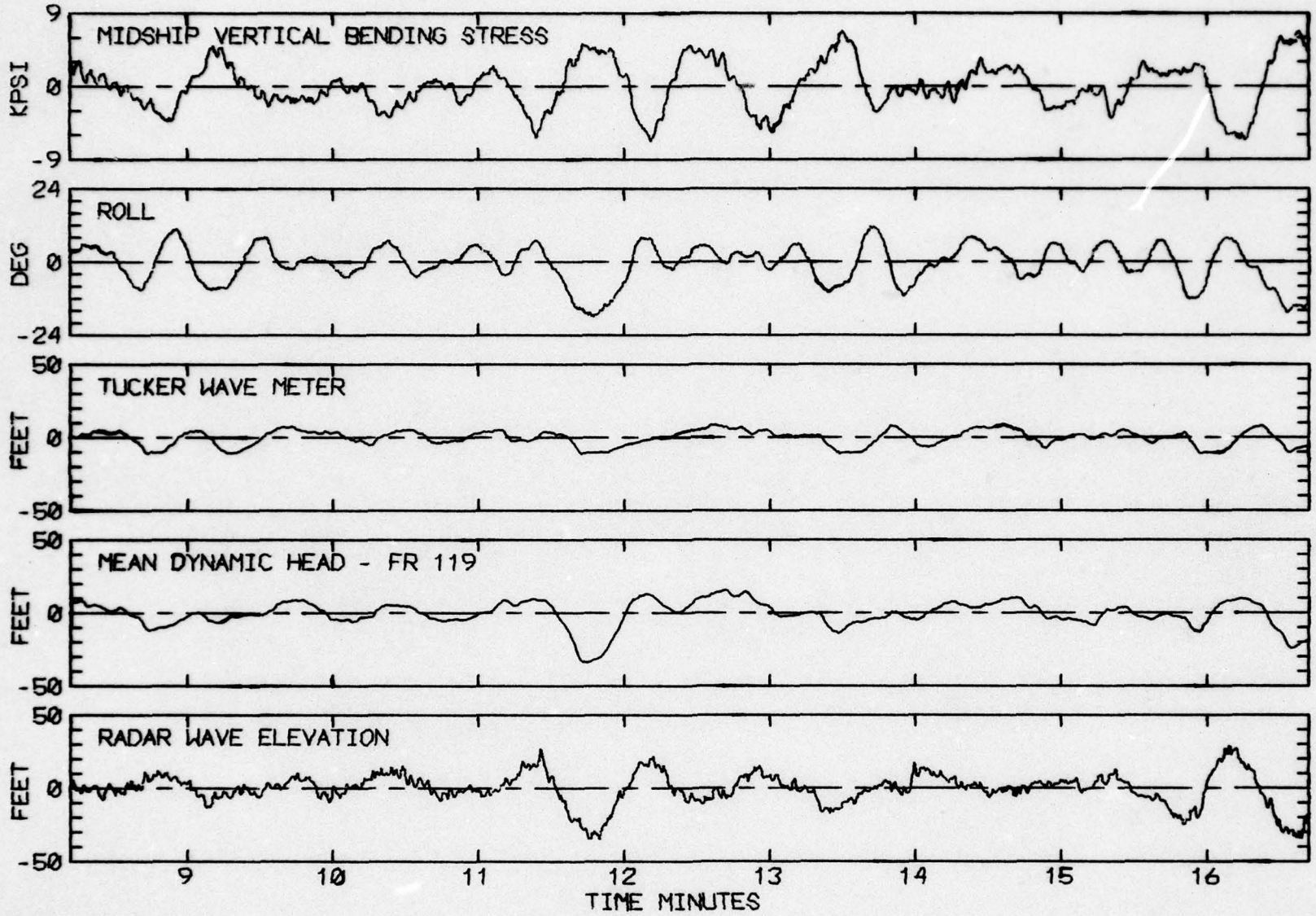
ROLL	21.4 DEG
PITCH	0.85 DEG
DK HSE VERT ACCEL	0.14 G
DK HSE LAT ACCEL	0.44 G
RADAR SLANT RANGE	50.3 FEET
VERTICAL RANGE	30.3 FEET
DISPL AT RADAR	23.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	41	31	93
MAXIMUM HEIGHT	19.4	44.4	62.9
10TH HIGHEST HTS	16.9	35.5	32.0
3RD HIGHEST HTS	13.2	23.4	19.4
4.0 RMS(SPECTRA)	19.3	33.1	38.5



RUN 713 -- VOYAGE 33E -- TAPE 151 -- INDEX 20 -- INTERVAL 13



RUN 713 -- VOYAGE 33E -- TAPE 151 -- INDEX 20 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	01-20-74 1200
POSITION	46-57 N 23-30 W
COURSE AND SPEED	079 . 32.4 KNOTS
SEA STATE	5
WAVE HEIGHT	4 FEET
" REL DIR	169 PORT
SWELL HEIGHT	8 FEET
" REL DIR	169 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

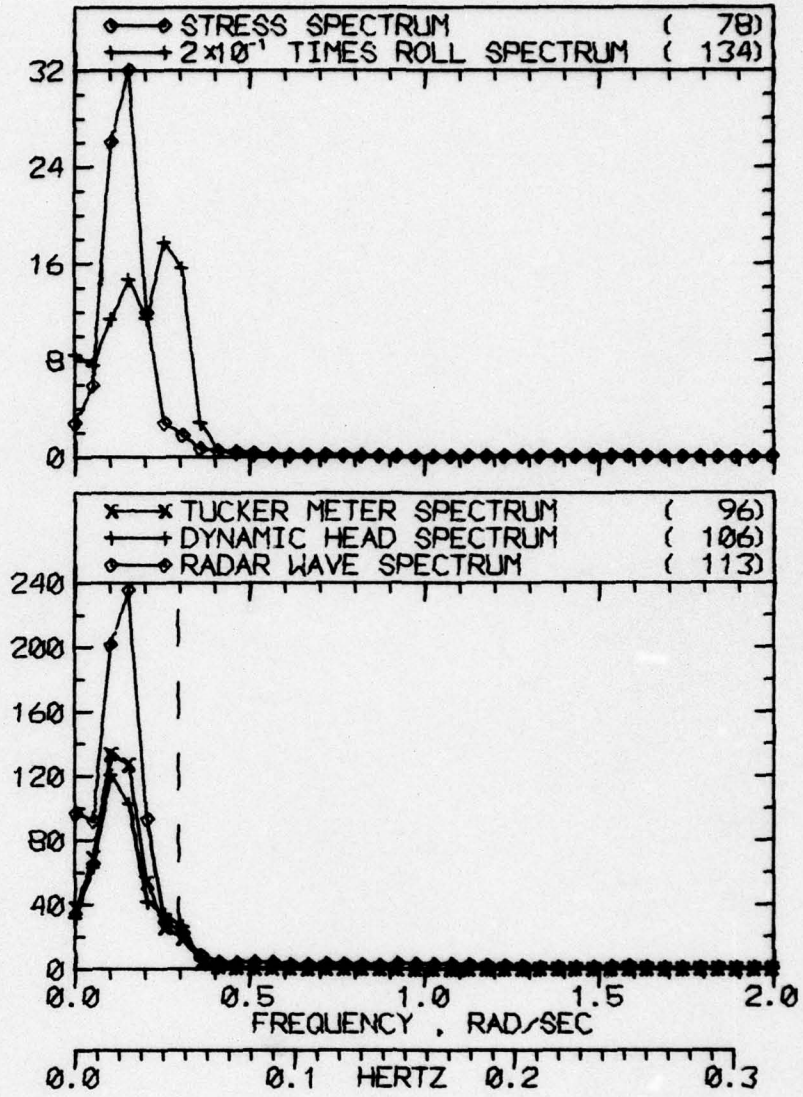
MAXIMUM PK-TR	12.4 KPSI
4.0 X RMS	8.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

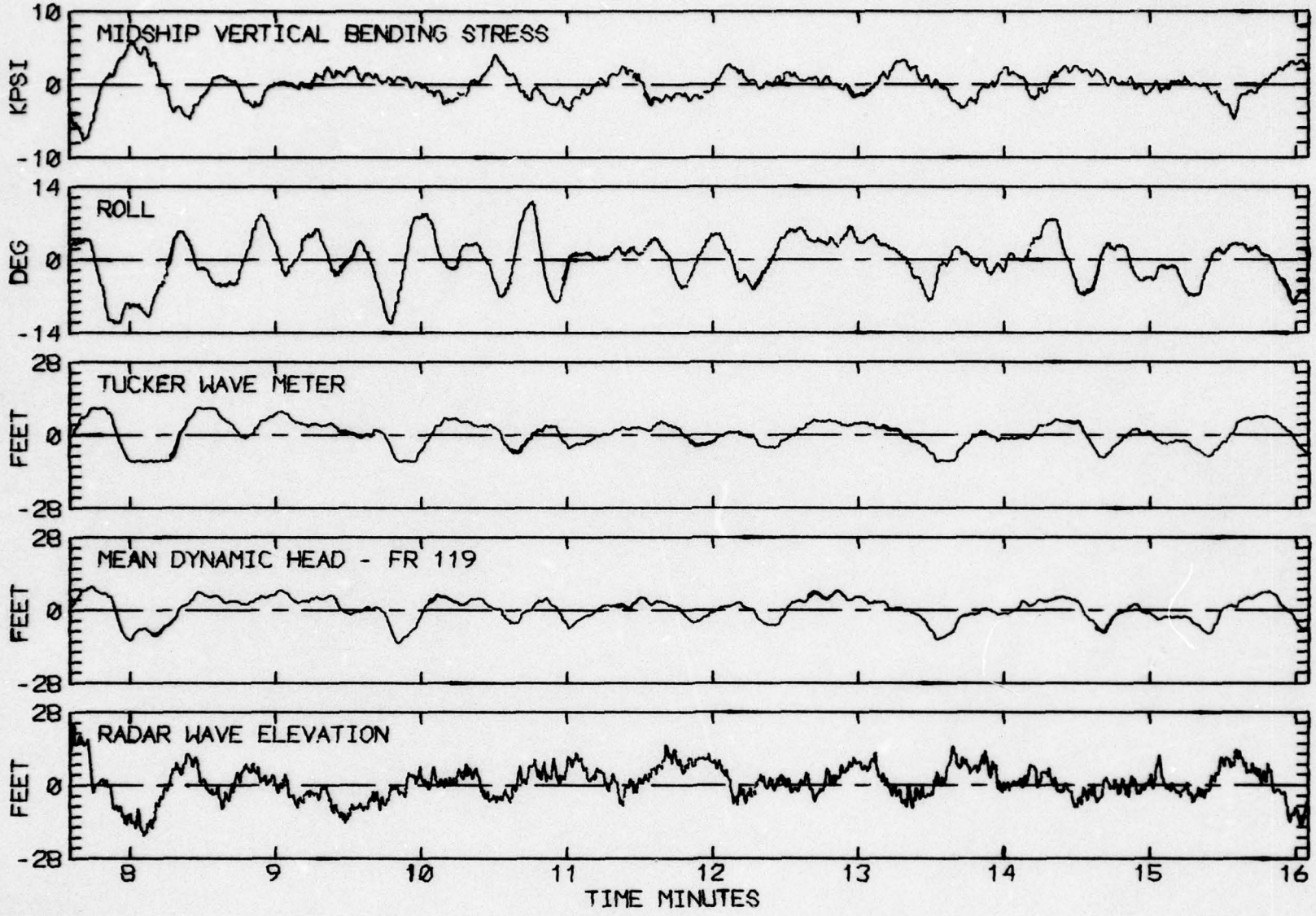
ROLL	18.9 DEG
PITCH	0.79 DEG
DK HSE VERT ACCEL	0.13 G
DK HSE LAT ACCEL	0.41 G
RADAR SLANT RANGE	43.1 FEET
VERTICAL RANGE	26.5 FEET
DISPL AT RADAR	8.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	46	43	111
MAXIMUM HEIGHT	20.6	23.2	29.8
10TH HIGHEST HTS	17.1	18.7	22.7
3RD HIGHEST HTS	13.5	13.8	15.2
4.0 RMS(SPECTRA)	19.4	18.5	26.0



RUN 717 -- VOYAGE 33E -- TAPE 151 -- INDEX 21 -- INTERVAL 17



RUN 717 -- VOYAGE 33E -- TAPE 151 -- INDEX 21 -- INTERVAL 17

LOG BOOK DATA

DATE AND TIME	01-20-74 1600
POSITION	46-57 N 23-30 W
COURSE AND SPEED	079 . 32.7 KNOTS
SEA STATE	4
WAVE HEIGHT	4 FEET
" REL DIR	124 PORT
SWELL HEIGHT	8 FEET
" REL DIR	169 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

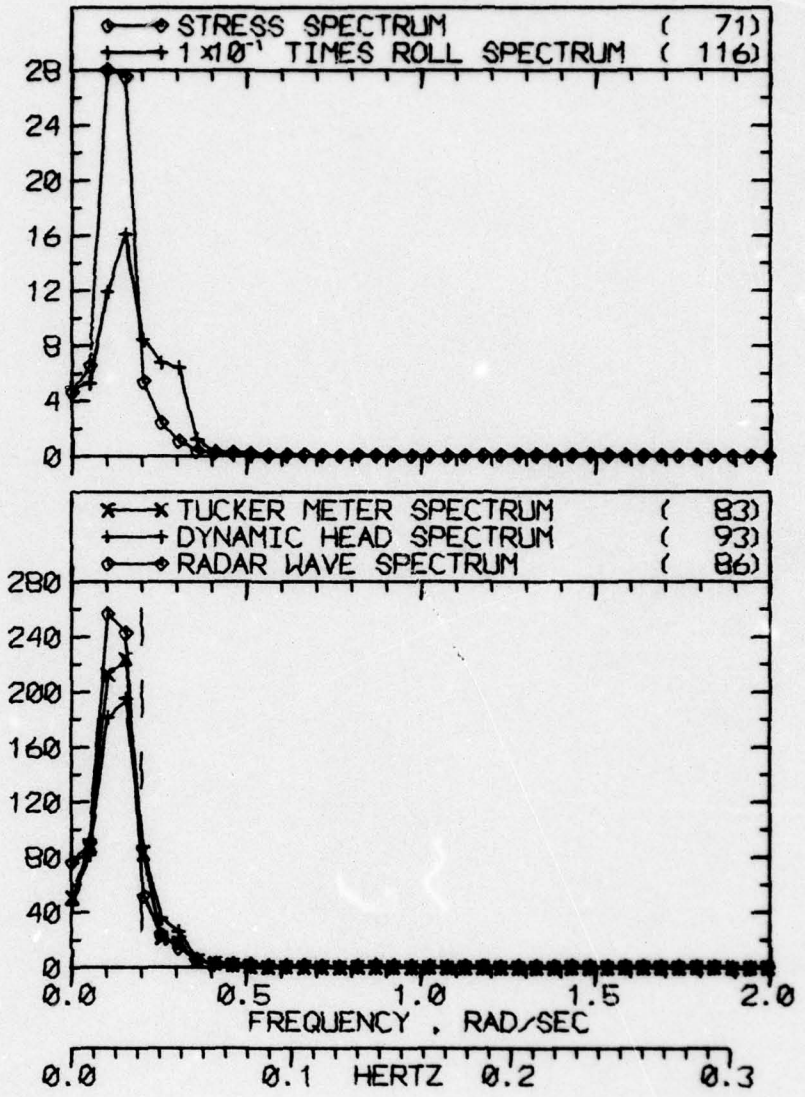
MAXIMUM PK-TR	9.8 KPSI
4.0 X RMS	7.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

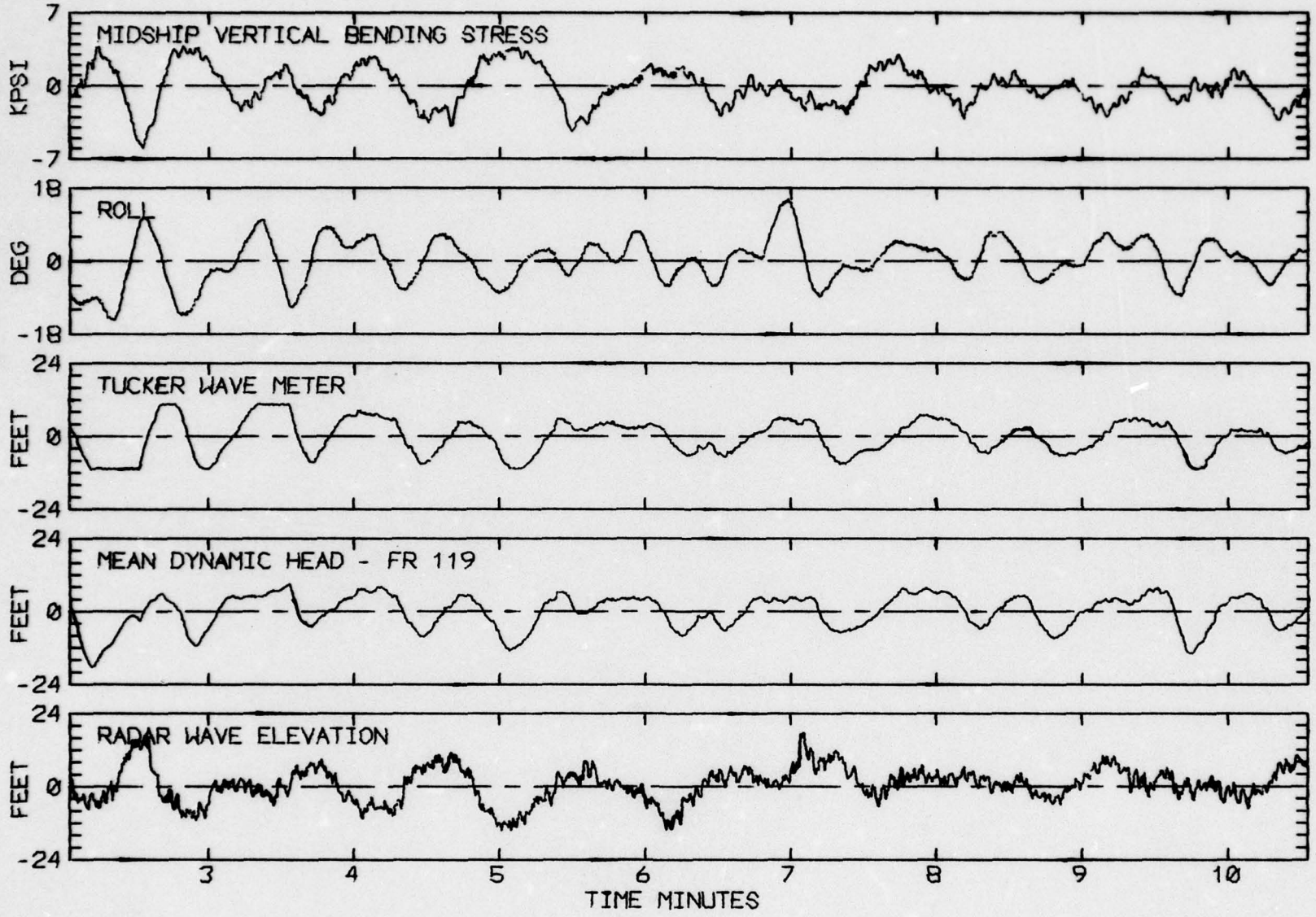
ROLL	22.0 DEG
PITCH	0.75 DEG
DK HSE VERT ACCEL	0.09 G
DK HSE LAT ACCEL	0.43 G
RADAR SLANT RANGE	43.6 FEET
VERTICAL RANGE	24.7 FEET
DISPL AT RADAR	9.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	30	25	96
MAXIMUM HEIGHT	21.5	25.3	27.6
10TH HIGHEST HTS	19.8	22.9	20.4
3RD HIGHEST HTS	17.0	19.4	13.0
4.0 RMS(SPECTRA)	23.7	23.0	25.2



RUN 721 -- VOYAGE 33E -- TAPE 151 -- INDEX 22 -- INTERVAL 21



RUN 721 -- VOYAGE 33E -- TAPE 151 -- INDEX 22 -- INTERVAL 21

LOG BOOK DATA

DATE AND TIME	01-20-74 2000
POSITION	46-57 N 23-30 W
COURSE AND SPEED	077 . 32.7 KNOTS
SEA STATE	4
WAVE HEIGHT	4 FEET
" REL DIR	167 PORT
SWELL HEIGHT	6 FEET
" REL DIR	167 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

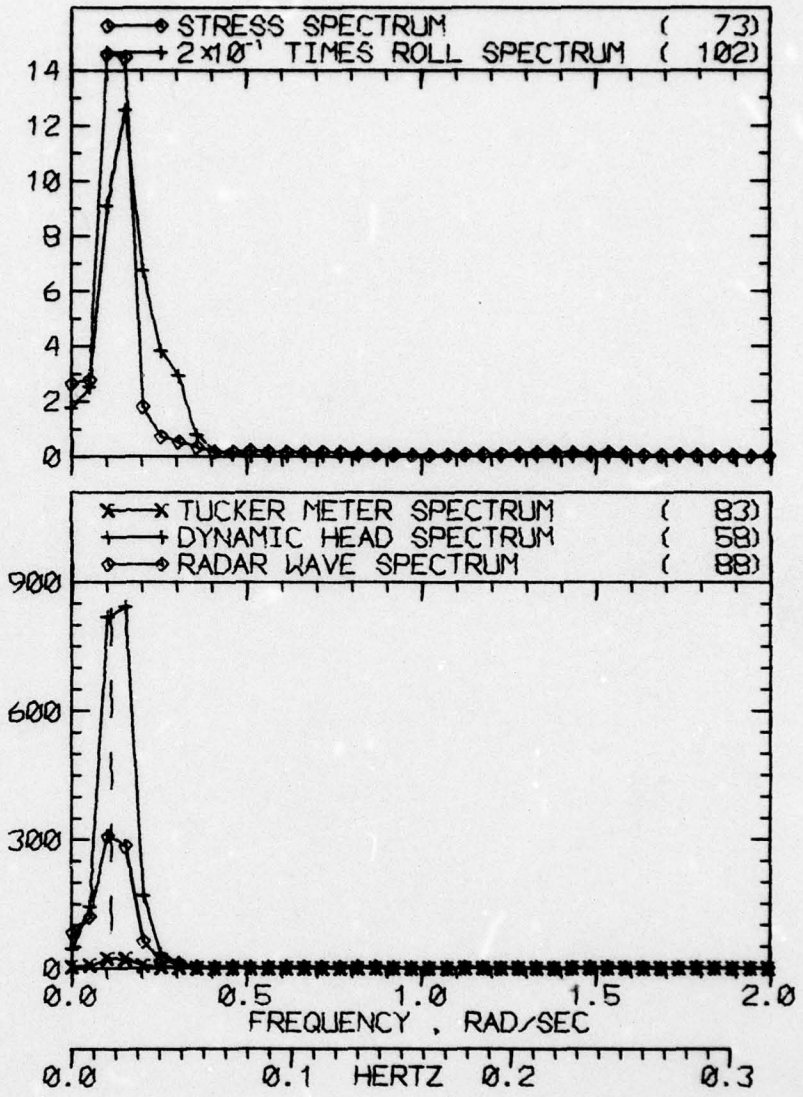
MAXIMUM PK-TR	10.8 KPSI
4.0 X RMS	5.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

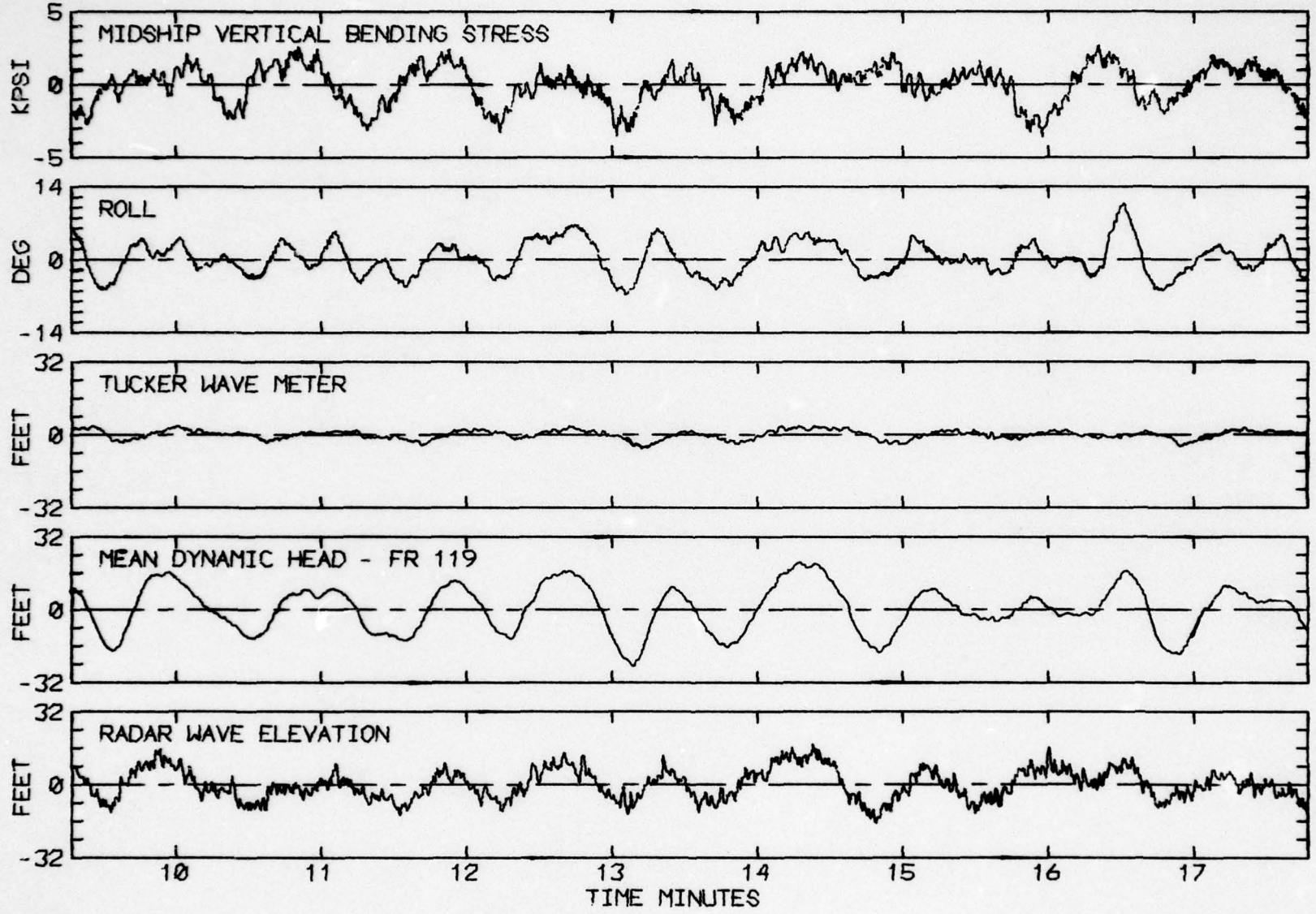
ROLL	12.9 DEG
PITCH	0.66 DEG
DK HSE VERT ACCEL	0.09 G
DK HSE LAT ACCEL	0.28 G
RADAR SLANT RANGE	23.5 FEET
VERTICAL RANGE	20.3 FEET
DISPL AT RADAR	30.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	137	23	101
MAXIMUM HEIGHT	6.4	42.2	34.9
10TH HIGHEST HTS	5.0	40.6	24.5
3RD HIGHEST HTS	3.3	34.0	15.6
4.0 RMS(SPECTRA)	7.5	40.9	27.7



RUN 725 -- VOYAGE 33E -- TAPE 151 -- INDEX 23 -- INTERVAL 25



RUN 725 -- VOYAGE 33E -- TAPE 151 -- INDEX 23 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	01-20-74 2400
POSITION	46-57 N 23-30 W
COURSE AND SPEED	077 . 32.0 KNOTS
SEA STATE	6
WAVE HEIGHT	6 FEET
" REL DIR	77 PORT
SWELL HEIGHT	6 FEET
" REL DIR	77 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

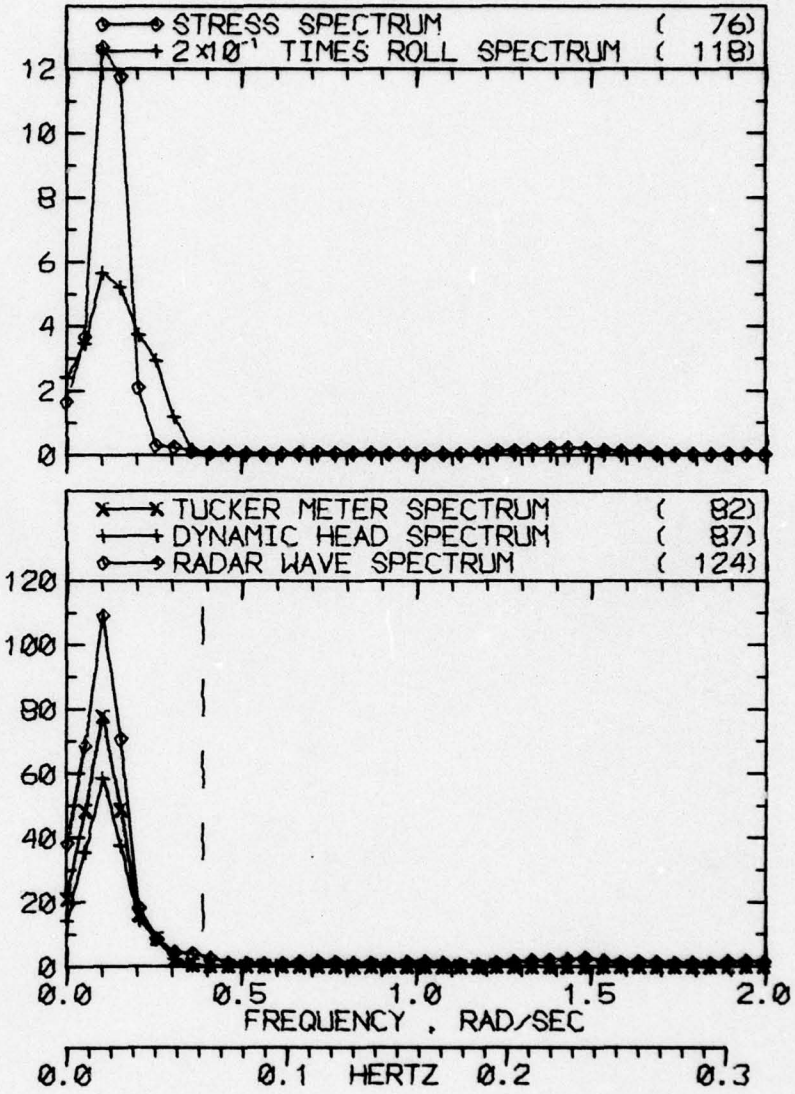
MAXIMUM PK-TR	6.6 KPSI
4.0 X RMS	5.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

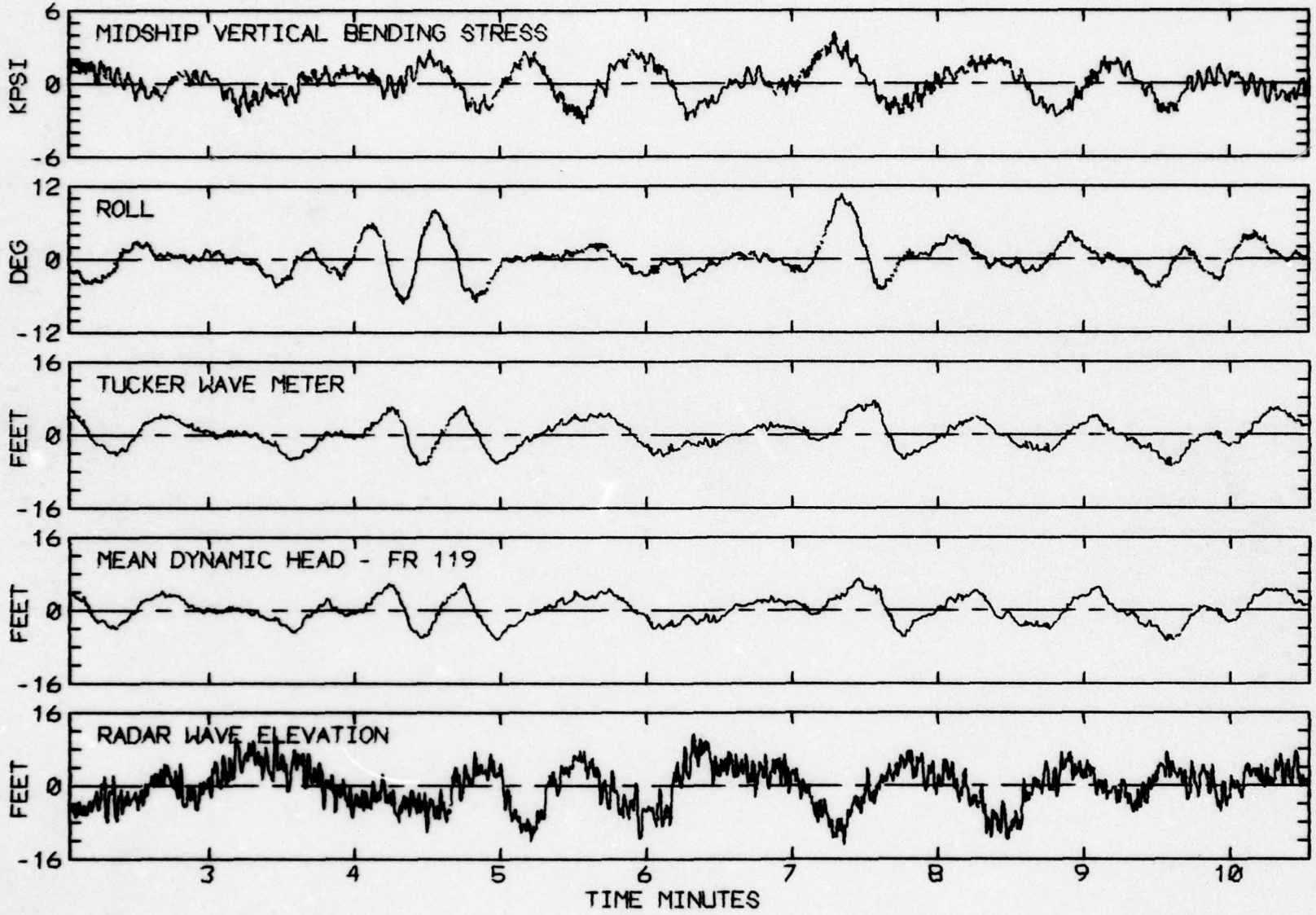
ROLL	9.9 DEG
PITCH	0.62 DEG
DK HSE VERT ACCEL	0.08 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	22.2 FEET
VERTICAL RANGE	18.2 FEET
DISPL AT RADAR	3.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	85	59	177
MAXIMUM HEIGHT	12.7	12.7	20.0
10TH HIGHEST HTS	9.0	10.4	13.2
3RD HIGHEST HTS	5.7	6.7	9.8
4.0 RMS(SPECTRA)	13.3	11.7	17.6



RUN 729 -- VOYAGE 33E -- TAPE 151 -- INDEX 24 -- INTERVAL 29



RUN 729 -- VOYAGE 33E -- TAPE 151 -- INDEX 24 -- INTERVAL 29

LOG BOOK DATA

DATE AND TIME	01-21-74 0400
POSITION	46-57 N 23-30 W
COURSE AND SPEED	077 . 32.3 KNOTS
SEA STATE	6
WAVE HEIGHT	6 FEET
" REL DIR	35 STBD
SWELL HEIGHT	4 FEET
" REL DIR	35 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

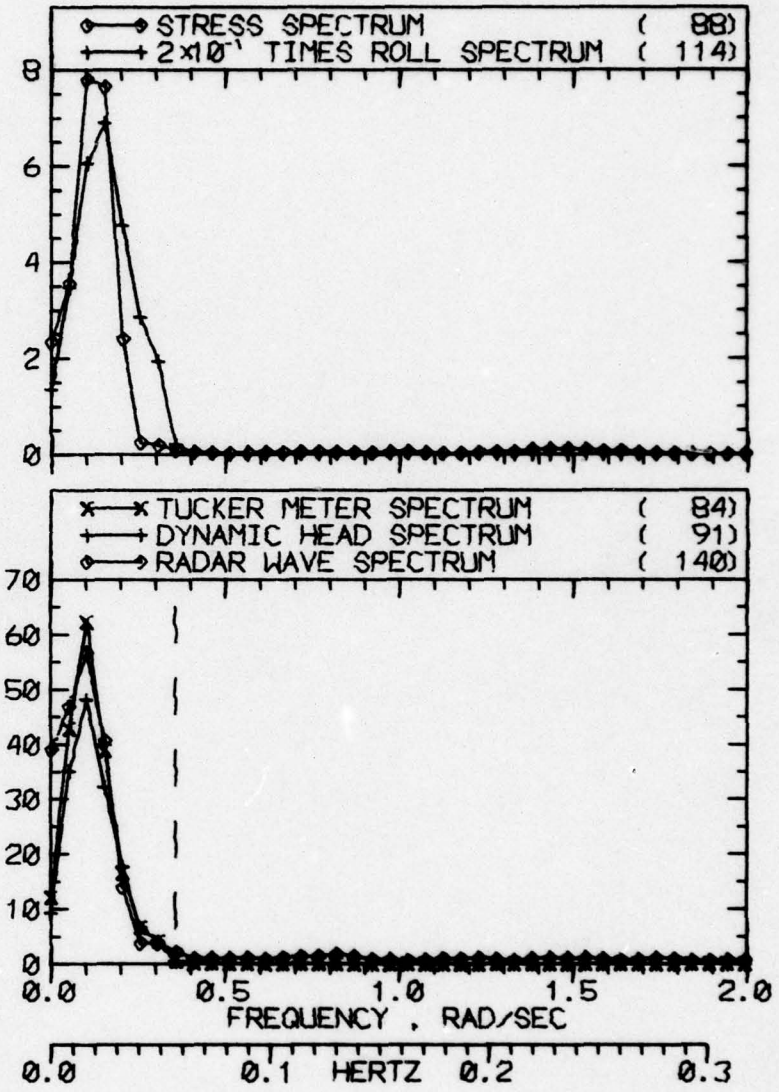
MAXIMUM PK-TR	4.6 KPSI
4.0 X RMS	4.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

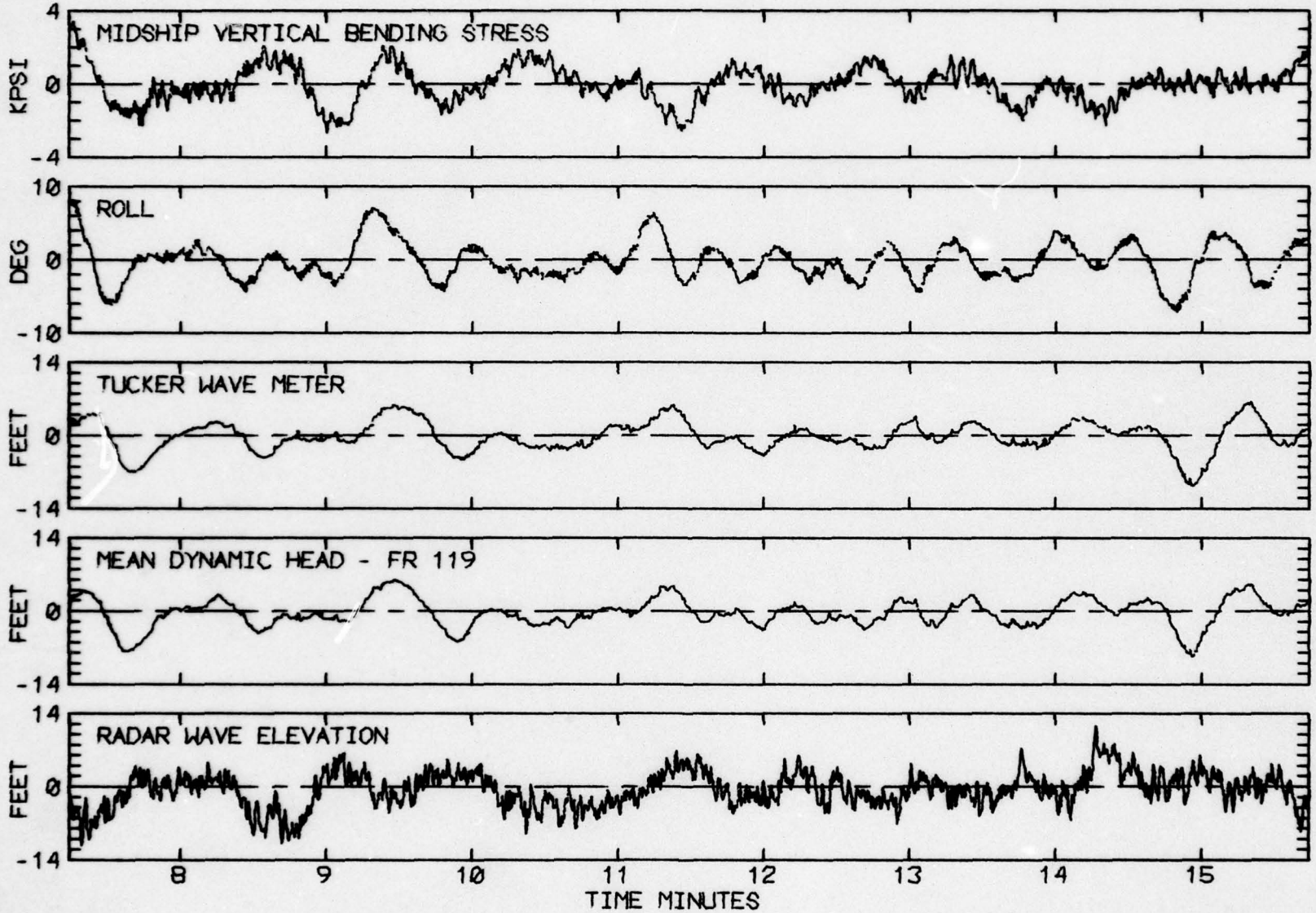
ROLL	10.6 DEG
PITCH	0.67 DEG
DK HSE VERT ACCEL	0.07 G
DK HSE LAT ACCEL	0.21 G
RADAR SLANT RANGE	20.2 FEET
VERTICAL RANGE	14.7 FEET
DISPL AT RADAR	3.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	74	61	197
MAXIMUM HEIGHT	10.7	11.1	13.1
10TH HIGHEST HTS	8.6	9.1	10.2
3RD HIGHEST HTS	5.5	6.6	7.6
4.0 RMS(SPECTRA)	12.1	11.1	14.0



RUN 733 -- VOYAGE 33E -- TAPE 151 -- INDEX 25 -- INTERVAL 33



RUN 733 -- VOYAGE 33E -- TAPE 151 -- INDEX 25 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	01-21-74 0800
POSITION	46-57 N 23-30 W
COURSE AND SPEED	077 . 32.9 KNOTS
SEA STATE	5
WAVE HEIGHT	6 FEET
" REL DIR	58 STBD
SWELL HEIGHT	4 FEET
" REL DIR	58 STBD

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

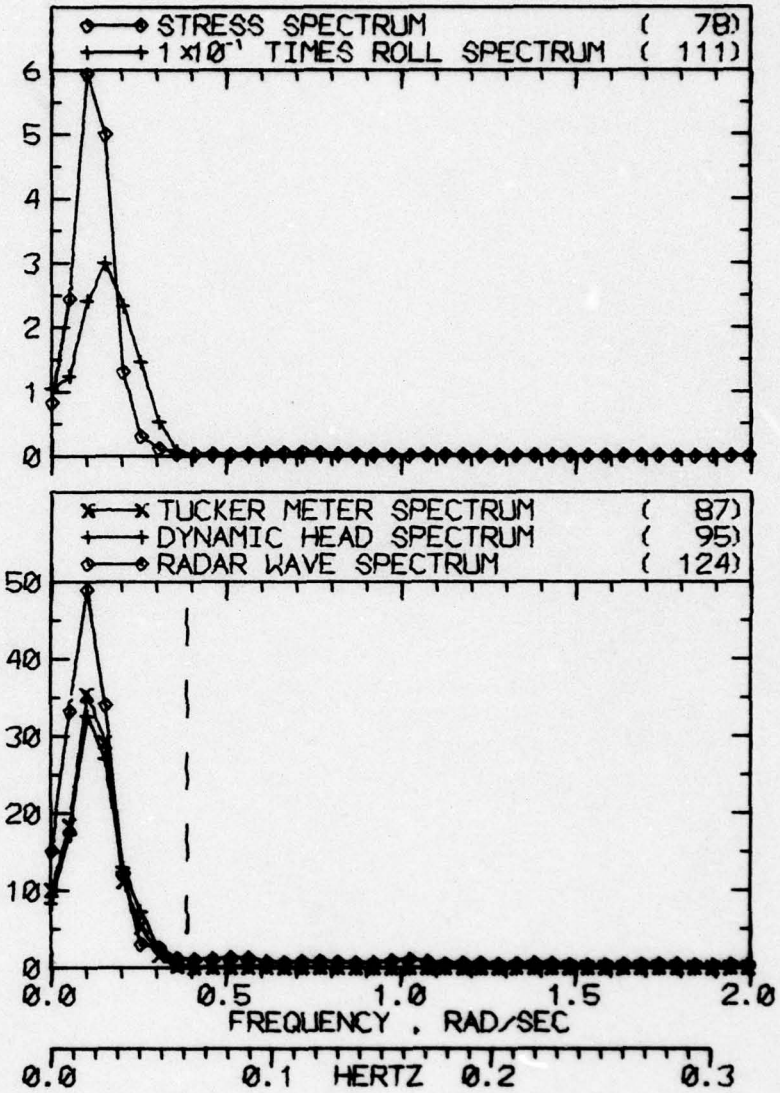
MAXIMUM PK-TR	4.8 KPSI
4.0 X RMS	3.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

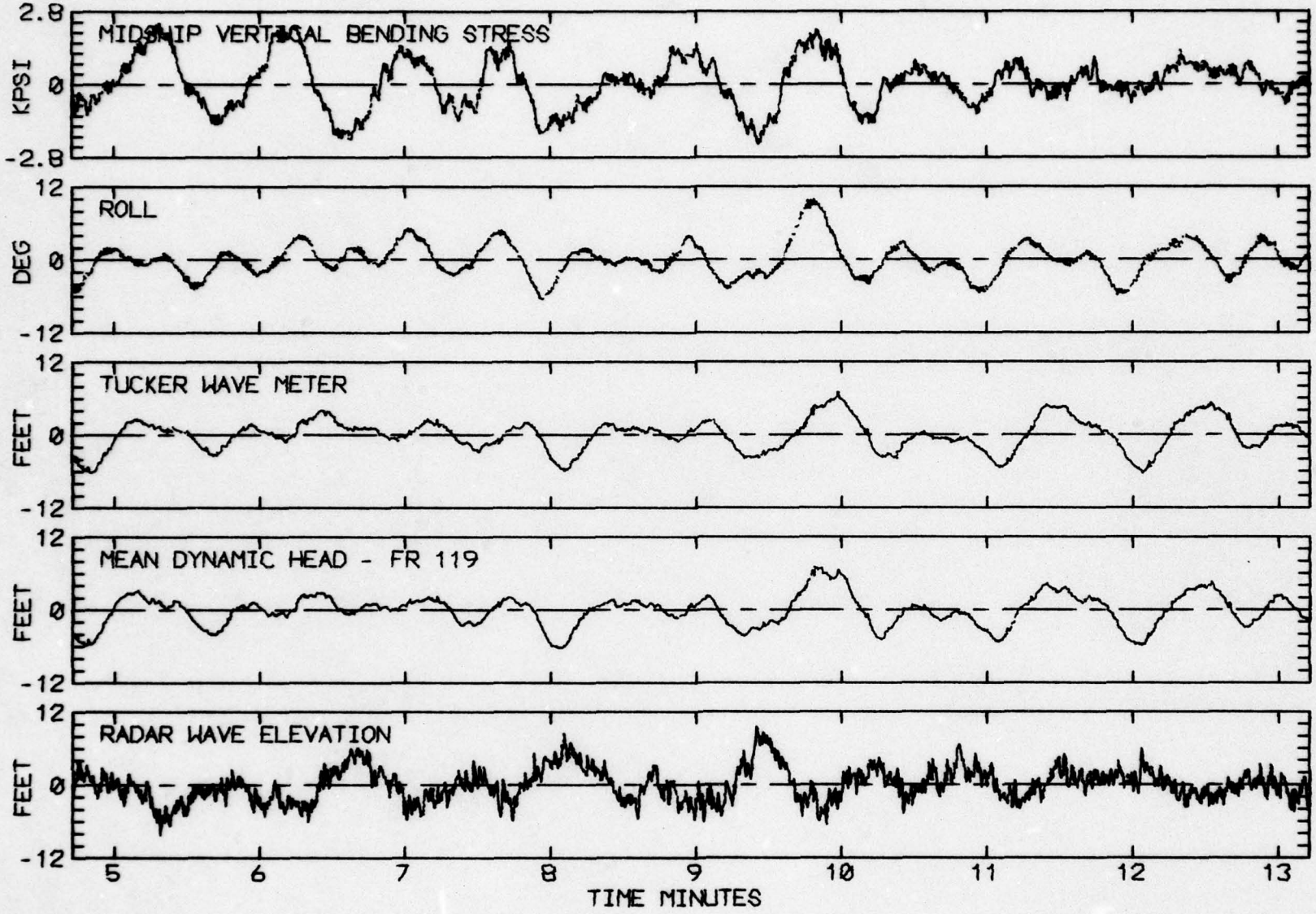
ROLL	9.8 DEG
PITCH	0.65 DEG
DK HSE VERT ACCEL	0.06 G
DK HSE LAT ACCEL	0.20 G
RADAR SLANT RANGE	15.3 FEET
VERTICAL RANGE	12.6 FEET
DISPL AT RADAR	2.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	89	62	235
MAXIMUM HEIGHT	10.7	12.2	14.0
10TH HIGHEST HTS	6.6	8.2	8.3
3RD HIGHEST HTS	4.2	5.3	5.9
4.0 RMS(SPECTRA)	9.4	9.3	12.0



RUN 737 -- VOYAGE 33E -- TAPE 151 -- INDEX 26 -- INTERVAL 37



RUN 737 -- VOYAGE 33E -- TAPE 151 -- INDEX 26 -- INTERVAL 37

TABLE IIa

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 1 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 WEST

D.L. RUN NO.	TMR TAPE NO.	TMR INDX NO.	TMR INTV NO.	DATE	TIME (GMT)	LATITUDE	LONGITUDE	COURSE	SPEED KT.	PROP RPM	DRAFT FT.	SEA/AIR TEMP
815	153	4	15	01-24-74	0400			245	32.3	131.0	30.10	50/47
817	153	5	17	01-24-74	0800			245	32.3	131.0	30.19	51/49
822	153	6	22	01-24-74	1200	47-33 N	11-56 W	247	32.2	130.6	30.20	52/50
825	153	7	25	01-24-74	1600	47-33 N	11-56 W	248	33.3	135.1	30.10	53/52
829	153	8	29	01-24-74	2000	47-33 N	11-56 W	246	32.4	131.4	30.15	52/50
833	153	9	33	01-24-74	2400	47-33 N	11-56 W	246	31.9	129.4	30.02	58/50
837	153	10	37	01-25-74	0400	47-33 N	11-56 W	246	32.1	130.3	29.90	53/50
841	153	11	41	01-25-74	0800	47-33 N	11-56 W	246	32.1	130.0	29.88	54/51
845	153	12	45	01-25-74	1200	42-51 N	28-27 W	265	31.8	129.0	29.81	56/55
849	153	13	49	01-25-74	1410	42-51 N	28-27 W	266	31.8	128.9	29.80	57/52
853	153	14	53	01-25-74	1620	42-51 N	28-27 W	266	31.8	128.9	29.80	57/52
861	153	16	61	01-25-74	2040	42-51 N	28-27 W	266	32.0	129.8	30.02	65/49
901	155	17	1	01-25-74	2400	42-51 N	28-27 W	266	31.2	126.7	30.03	57/48
905	155	18	5	01-26-74	0400	42-51 N	28-27 W	266	31.8	129.0	30.00	56/51
909	155	19	9	01-26-74	0800	42-51 N	28-27 W	266	32.6	132.0	30.05	61/49
913	155	20	13	01-26-74	1200	41-50 N	45-25 W	266	32.4	131.2	30.03	58/50
917	155	21	17	01-26-74	1600	41-50 N	45-25 W	266	32.3	130.9	30.11	44/39
921	155	22	21	01-26-74	2000	41-50 N	45-25 W	267	33.1	134.7	30.37	58/36
925	155	23	25	01-26-74	2400	41-50 N	45-25 W	267	32.4	131.2	30.45	63/44
929	155	24	29	01-27-74	0400	41-50 N	45-25 W	267	32.4	131.4	30.38	58/52
937	155	26	37	01-27-74	1200	40-45 N	62-42 W	266	32.2	130.4	30.00	59/58
941	155	27	41	01-27-74	1600	40-45 N	62-42 W	265	31.8	128.9	29.77	65/65
945	155	28	45	01-27-74	2000	40-45 N	62-42 W	266	32.1	130.0	29.81	43/60
949	155	29	49	01-27-74	2400	40-45 N	62-42 W	268	32.3	131.1	29.88	43/60

TABLE IIb

SUMMARY OF TMR LOG-BOOK DATA CORRESPONDING TO
INTERVALS SELECTED FOR WAVE METER DATA REDUCTION (PAGE 2 OF 2)

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 WEST

D.L. RUN NO.	SEA STATE	<REL WIND> DIR/SPEED /(KT)	REL WAVE DIR	WAVE HT. FT.	REL SWELL DIR	<-SWELL-> HT FT.	LENGTH FT.	VISUAL WEATHER /TMR LOG-BOOK COMMENTS
815	4	2S/16	2S	2	2S	5	300	OCAST /PITCHING MODERATELY
817	4	25S/16	25S	1	25S	5	300	SCAT CLOUDS /GETTING GOOD VERT BEND
822	4	23S/20	23S	1	23S	4	250	SCAT CLOUDS /
825	5	12P/20	12P	2	22S	4	250	PT CLDY /PITCHING EASILY
829	4	10P/20	10P	2	10P	4	250	PT CLDY /
833	6	10P/25	24S	3	24S	4	250	PT CLDY /
837	6	1S/25	1S	5	1S	6	150	OCAST /PITCHING MODERATELY
841	7	21P/30	21P	5	21P	6	150	OCAST /
845	8	5S/35	5S	8	5S	6	150	PT CLDY /
849	9	4S/45	4S	8	4S	10	250	PT CLDY /MANUAL OPERATION HIGH WINDS
853	9	49S/45	49S	12	4S	10	250	PT CLDY /MORE VERT BENDING ACTION
861	9	26S/45	26S	12	26S	12	300	PT CLDY /SHIPPING WATER OVERDECKS
901	5	49S/20	4S	5	4S	10	300	PT CLDY /WIND DOWN TO 30 MPH
905	4	4S/15	4S	5	4S	8	250	OCAST /
909	3	26S/10	26S	1	26S	8	250	OCAST /
913	3	49S/10	4S	1	4S	8	250	OCAST /
917	6	49S/15	49S	2	49S	8	250	PT CLDY /
921	4	48S/15	48S	2	48S	6	300	CLDY /
925	4	48S/15	48S	2	48S	6	300	CLEAR /
929	3	48S/15	48S	1	48S	6	300	CLEAR /
937	8	41P/35	41P	6	41P	8	400	RAIN SQUALLS /
941	9	40P/40	40P	8	40P	8	400	OCAST /
945	8	41P/35	41P	5	41P	5	400	CLDY /
949	6	43P/25	43P	5	43P	5	400	CLDY /

TABLE 11c

COMPARISON OF TMR RESULTS FOR MIDSHIP VERTICAL BENDING STRESS
WITH CORRESPONDING RAW DIGITIZATION RESULTS AT DAVIDSON LABORATORY

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 WEST

	<----TMR RESULTS---->					<----D.L. DIGITIZATION---->			<--COLUMN RATIOS-->		
D.L. RUN NO.	NO. WAVE INDUCED CYCLES (1)	NO. 1ST MODE BURSTS (2)	MAX P-TO-T STRESS KPSI (3)	RMS P-TO-T STRESS KPSI (4)	MAX 1ST MODE STRESS KPSI (5)	RANGE OF RECORDED EXTREMES KPSI (6)	2.83X (SAMPLE RMS) KPSI (7)	REL MEAN STRESS KPSI (8)	(7) / (4)	(6) / (3+5)	(6) / (3)
815	158	53	11.24	4.73	3.72	13.09	4.87	-0.37	1.03	0.87	1.16
817	175	40	8.57	4.04	2.56	11.04	4.00	-1.05	0.99	0.99	1.29
822	172	17	6.96	3.25	2.43	7.31	3.23	-1.04	0.99	0.78	1.05
825	180	7	5.97	2.76	1.28	7.53	2.89	-1.27	1.05	1.04	1.26
829	177	10	4.56	2.00	1.16	5.88	2.32	-1.30	1.16	1.03	1.29
833	204	38	4.97	2.23	2.17	6.86	2.63	-1.40	1.18	0.96	1.38
837	197	53	6.50	3.16	3.68	9.53	3.45	-1.35	1.09	0.94	1.47
841	205	66	9.50	3.84	5.04	15.31	4.10	-1.29	1.07	1.05	1.61
845	200	50	8.30	3.41	2.57	10.34	3.67	0.60	1.08	0.95	1.24
849	219	51	7.42	3.21	2.75	13.85	3.89	0.84	1.21	1.36	1.87
853	214	62	9.96	3.86	4.49	13.99	4.58	0.92	1.19	0.97	1.41
861	181	86	17.35	6.06	12.58	25.02	6.66	1.18	1.10	0.84	1.44
901	197	64	9.66	4.31	4.57	13.26	4.49	0.73	1.04	0.93	1.37
905	202	25	5.45	2.52	1.48	8.04	2.69	0.51	1.06	1.16	1.47
909	187	4	4.21	1.78	1.16	5.84	2.07	0.46	1.16	1.09	1.38
913	177	1	3.49	1.70	0.73	5.36	2.11	0.65	1.24	1.27	1.54
917	125	16	3.25	1.29	1.22	4.44	1.61	0.49	1.25	0.99	1.37
921	110	0	1.99	0.90	0.00	3.01	1.12	0.51	1.25	1.51	1.51
925	101	0	1.99	0.91	0.00	2.87	1.20	0.44	1.32	1.44	1.44
929	153	0	1.45	0.76	0.00	2.42	0.98	0.29	1.30	1.66	1.66
937	113	1	0.90	0.43	1.22	1.87	0.70	-1.13	1.64	0.88	2.07
941	240	38	4.37	1.59	1.47	6.43	2.21	-0.73	1.39	1.10	1.47
945	228	16	2.84	1.17	1.22	4.54	1.59	-0.38	1.36	1.12	1.60
949	212	37	4.73	2.19	1.85	6.66	2.66	-0.80	1.21	1.01	1.41

TABLE IId

SUMMARY OF RAW DIGITIZATION RESULTS FOR RADAR RANGE
ROLL, PITCH, DECK HOUSE ACCELERATIONS, AND TUCKER METER

SEA LAND MC LEAN : 1973-1974 WINTER SEASON : VOYAGE 33 WEST

	<--- RADAR --->			<--- ROLL ---->			<--- PITCH --->			<--VERT ACCEL->			<--LAT ACCEL-->			<-- TUCKER -->		
D.L. RUN NO.	4.0 (RMS) FT	RECORDED EXTREMES FT		4.0 (RMS) DEG	RECORDED EXTREMES DEG		4.0 (RMS) DEG	RECORDED EXTREMES DEG		4.0 (RMS) (G)	RECORDED EXTREMES (G)		4.0 (RMS) (G)	RECORDED EXTREMES (G)		4.0 (RMS) FT	RECORDED EXTREMES FT	
815	46.	37.	-44.	6.8	4.	-7.	2.2	1.7	-2.1	0.49	0.4	-0.4	0.17	0.1	-0.1	9.	7.	-7.
817	34.	30.	-32.	4.5	3.	-5.	1.8	0.9	-1.9	0.40	0.3	-0.3	0.13	0.1	-0.1	6.	5.	-5.
822	29.	25.	-24.	4.6	2.	-5.	1.5	1.0	-1.9	0.34	0.3	-0.3	0.12	0.1	-0.1	5.	4.	-4.
825	26.	24.	-20.	4.8	2.	-6.	1.3	0.6	-1.9	0.30	0.2	-0.3	0.12	0.1	-0.1	5.	4.	-5.
829	22.	24.	-19.	5.3	3.	-5.	1.0	0.5	-1.8	0.24	0.2	-0.2	0.14	0.1	-0.1	5.	5.	-3.
833	22.	21.	-23.	4.3	3.	-4.	1.1	0.4	-1.6	0.23	0.2	-0.2	0.12	0.1	-0.1	4.	3.	-3.
837	29.	23.	-22.	3.7	3.	-3.	1.5	0.6	-1.9	0.34	0.3	-0.3	0.11	0.1	-0.1	4.	3.	-3.
841	36.	30.	-45.	4.0	3.	-5.	1.5	0.8	-2.1	0.34	0.4	-0.3	0.12	0.1	-0.1	5.	4.	-4.
845	27.	30.	-32.	2.9	3.	-2.	1.4	0.8	-1.7	0.30	0.3	-0.3	0.09	0.1	-0.1	3.	3.	-3.
849	27.	28.	-40.	2.9	3.	-3.	1.3	0.7	-1.8	0.26	0.3	-0.3	0.09	0.1	-0.1	4.	3.	-3.
853	33.	28.	-45.	3.7	2.	-4.	1.6	1.2	-2.1	0.35	0.4	-0.3	0.11	0.1	-0.1	4.	4.	-3.
861	60.	44.	-51.	5.4	3.	-9.	2.4	2.5	-2.1	0.59	0.6	-0.5	0.16	0.2	-0.2	7.	6.	-7.
901	35.	29.	-47.	4.7	2.	-6.	1.6	1.0	-1.7	0.40	0.3	-0.3	0.14	0.1	-0.1	5.	4.	-4.
905	24.	20.	-19.	4.4	2.	-6.	1.2	0.4	-1.9	0.27	0.2	-0.2	0.12	0.1	-0.1	4.	3.	-4.
909	19.	15.	-18.	5.3	1.	-7.	0.8	0.2	-1.4	0.19	0.2	-0.2	0.13	0.1	-0.1	4.	3.	-4.
913	23.	18.	-20.	10.1	5.	-12.	0.9	0.4	-1.3	0.19	0.2	-0.2	0.23	0.2	-0.2	4.	4.	-3.
917	20.	17.	-17.	9.1	3.	-12.	0.6	-0.0	-1.2	0.13	0.1	-0.1	0.20	0.2	-0.2	4.	4.	-3.
921	12.	10.	-11.	5.5	4.	-6.	0.6	-0.1	-1.0	0.06	0.1	-0.1	0.13	0.1	-0.1	2.	2.	-2.
925	13.	11.	-11.	5.9	2.	-7.	0.6	-0.1	-1.1	0.06	0.1	-0.1	0.13	0.1	-0.1	2.	1.	-2.
929	10.	8.	-9.	4.3	3.	-4.	0.7	0.1	-1.1	0.08	0.1	-0.1	0.10	0.1	-0.1	1.	1.	-1.
937	7.	6.	-7.	3.3	5.	1.	0.6	-0.2	-1.0	0.04	0.0	-0.0	0.08	0.1	-0.1	1.	1.	-1.
941	17.	13.	-14.	4.3	9.	2.	0.8	0.2	-1.1	0.14	0.1	-0.1	0.11	0.1	-0.1	2.	2.	-2.
945	13.	12.	-12.	4.9	7.	-2.	0.7	0.1	-1.0	0.11	0.1	-0.1	0.12	0.1	-0.1	2.	2.	-2.
949	19.	14.	-15.	5.7	8.	-4.	1.3	0.8	-1.4	0.28	0.3	-0.2	0.15	0.2	-0.1	3.	3.	-3.

LOG BOOK DATA

DATE AND TIME	01-24-74 0400
POSITION	
COURSE AND SPEED	245 , 32.3 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	2 STBD
SWELL HEIGHT	5 FEET
" REL DIR	2 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /PITCHING MODERATELY

MIDSHIP VERTICAL BENDING STRESS

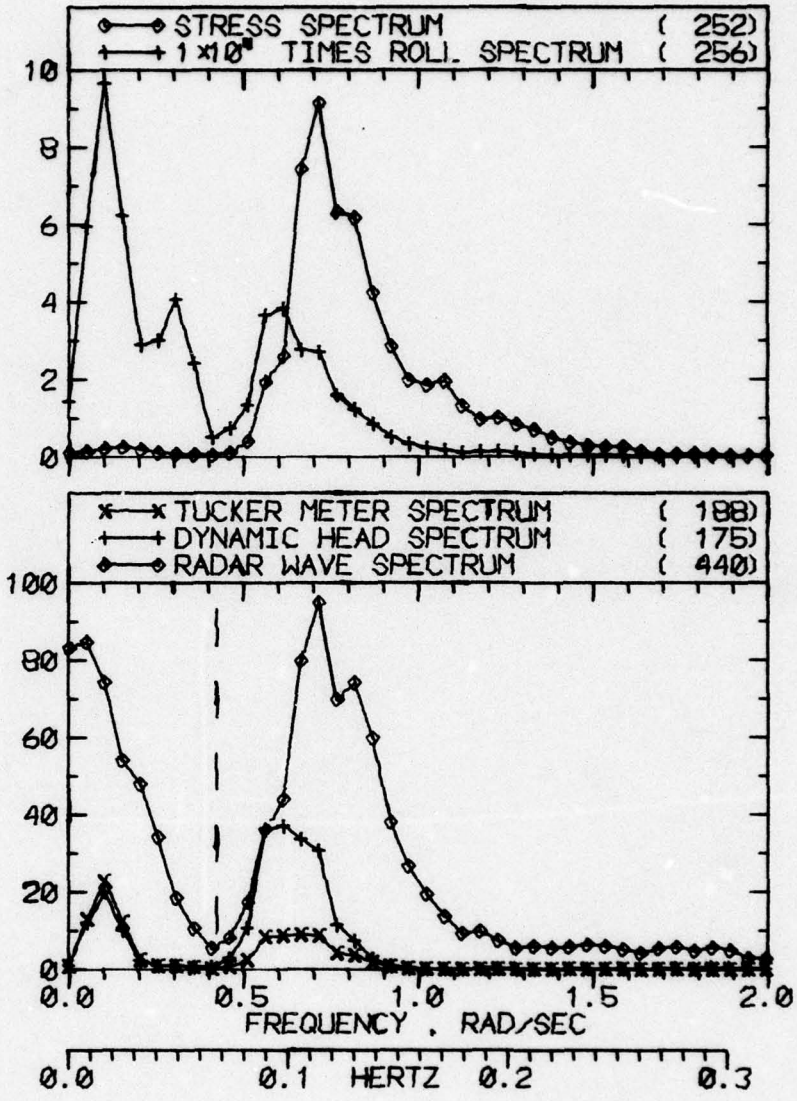
MAXIMUM PK-TR	11.2 KPSI
4.0 X RMS	6.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

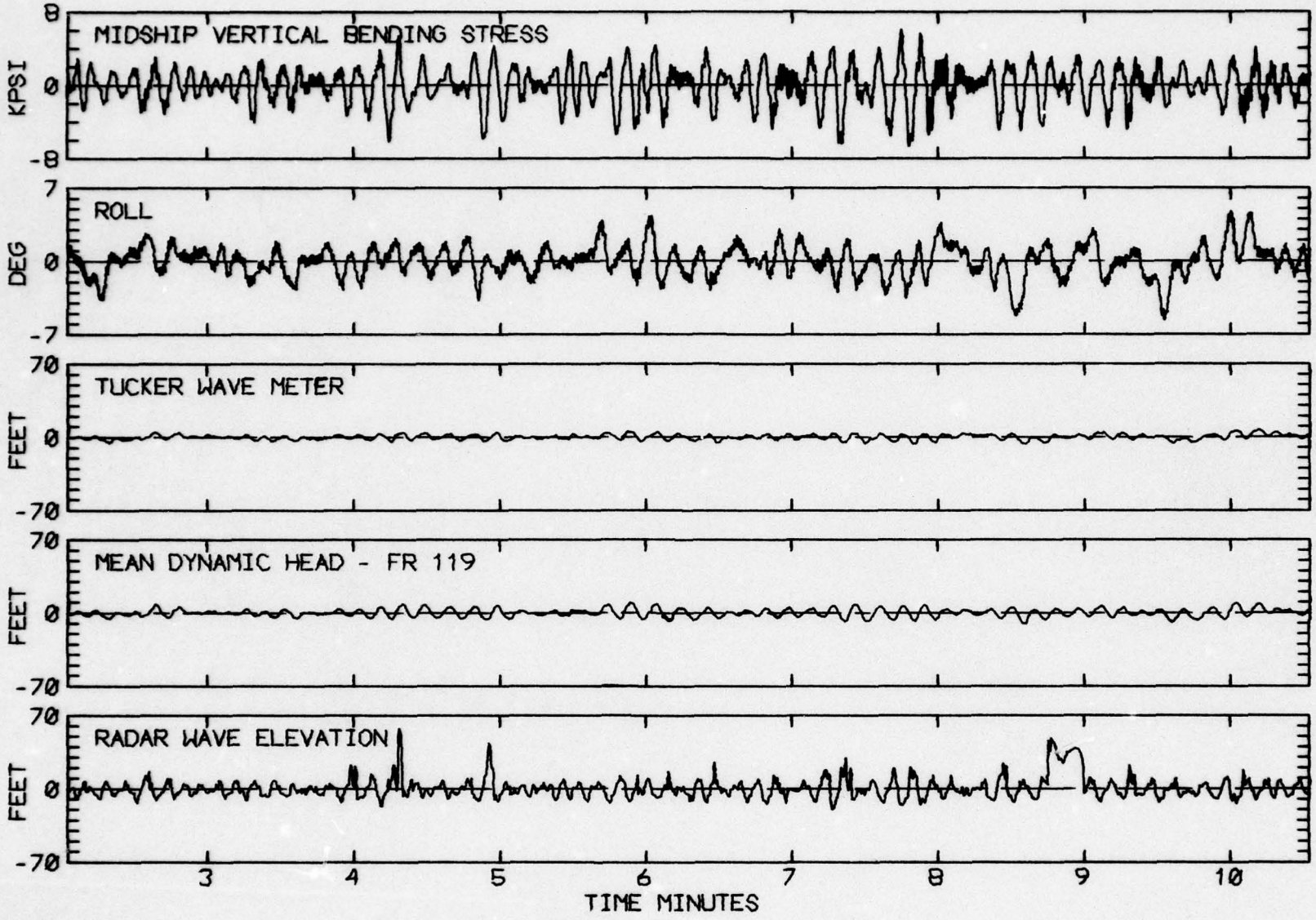
ROLL	6.9 DEG
PITCH	2.22 DEG
DK HSE VERT ACCEL	0.49 G
DK HSE LAT ACCEL	0.17 G
RADAR SLANT RANGE	46.2 FEET
VERTICAL RANGE	45.2 FEET
DISPL AT RADAR	29.2 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	113	103	203
MAXIMUM HEIGHT	9.6	15.2	64.1
10TH HIGHEST HTS	8.5	14.5	35.0
3RD HIGHEST HTS	7.3	12.5	24.1
4.0 RMS(SPECTRA)	9.3	13.5	30.6



RUN 815 -- VOYAGE 33W -- TAPE 153 -- INDEX 4 -- INTERVAL 15



RUN 815 -- VOYAGE 33W -- TAPE 153 -- INDEX 4 -- INTERVAL 15

LOG BOOK DATA

DATE AND TIME	01-24-74 0800
POSITION	
COURSE AND SPEED	245 . 32.3 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	25 STBD
SWELL HEIGHT	5 FEET
" REL DIR	25 STBD

---- VISUAL WEATHER / COMMENTS ----

SCAT CLOUDS /GETTING GOOD VERT BEND

MIDSHIP VERTICAL BENDING STRESS

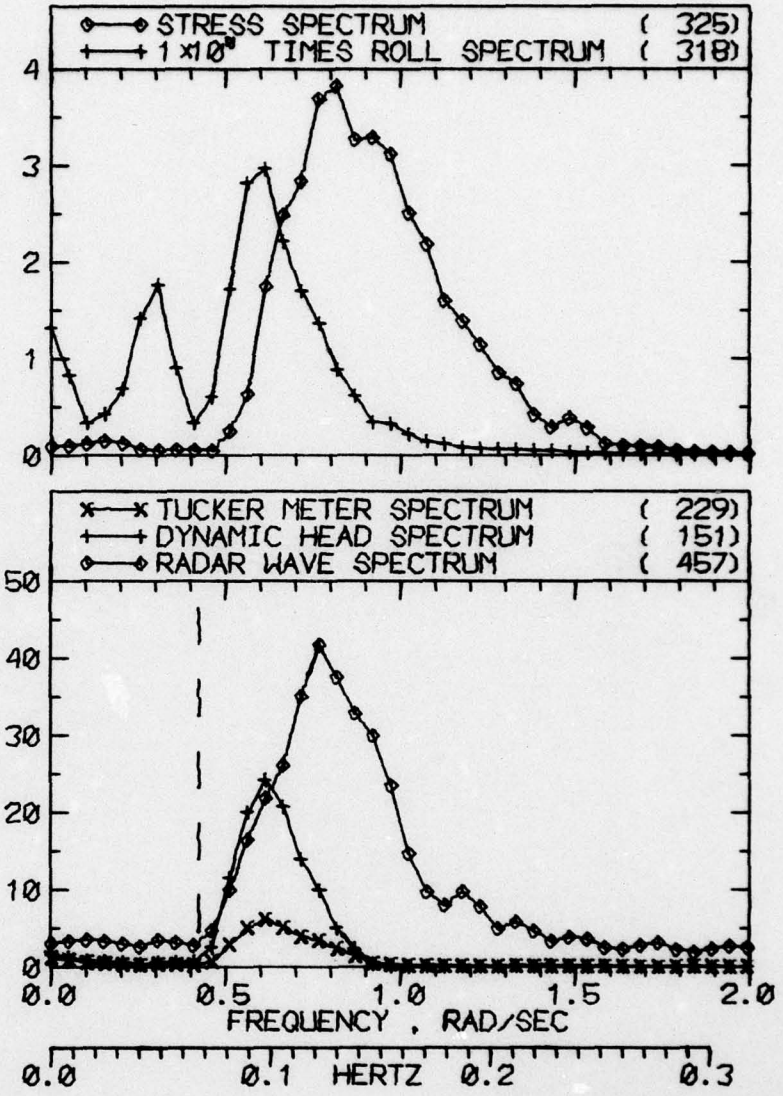
MAXIMUM PK-TR	8.6 KPSI
4.0 X RMS	5.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

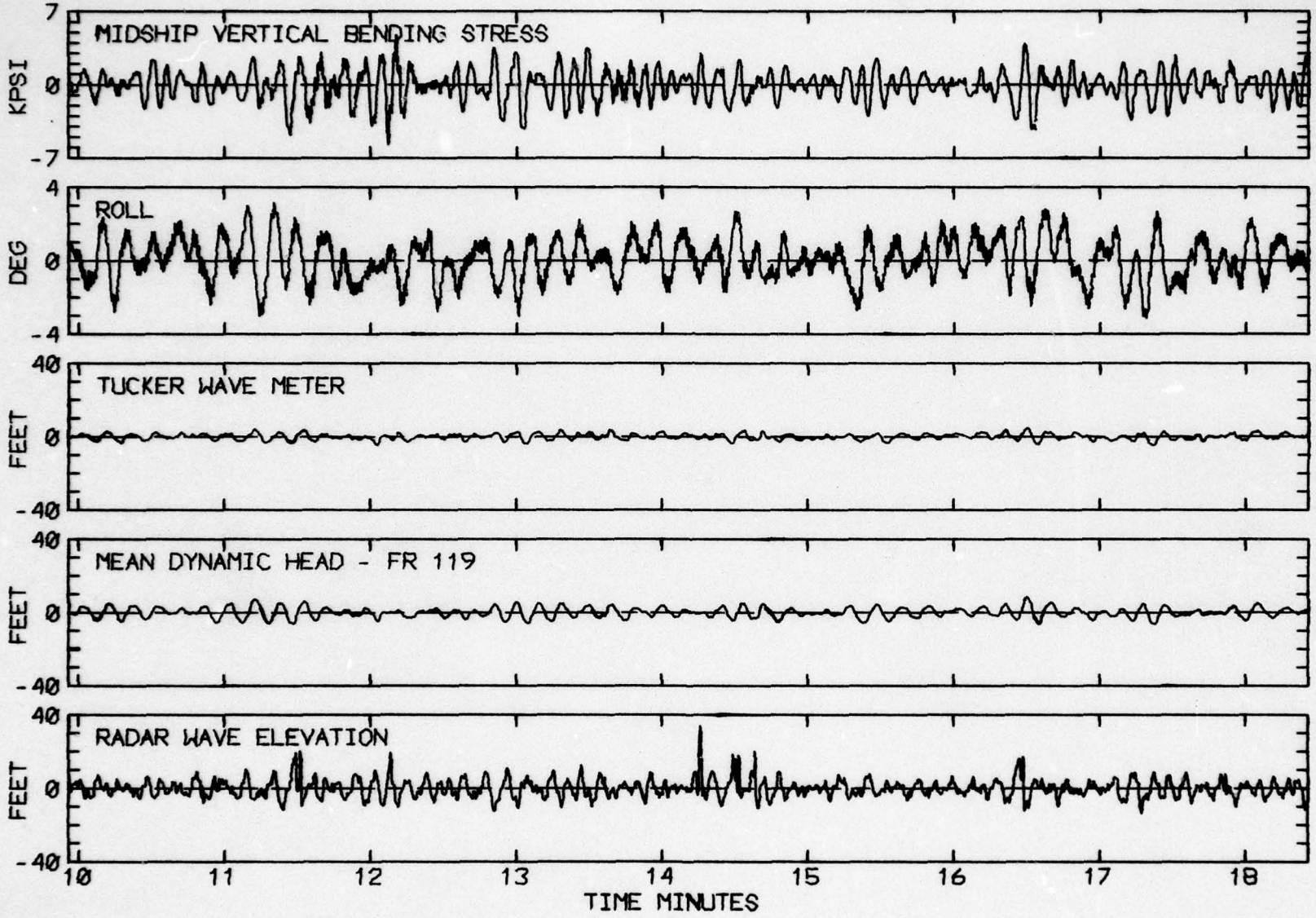
ROLL	4.5 DEG
PITCH	1.75 DEG
DK HSE VERT ACCEL	0.40 G
DK HSE LAT ACCEL	0.13 G
RADAR SLANT RANGE	33.8 FEET
VERTICAL RANGE	32.8 FEET
DISPL AT RADAR	22.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	160	115	226
MAXIMUM HEIGHT	8.8	14.3	40.3
10TH HIGHEST HTS	6.4	11.5	25.4
3RD HIGHEST HTS	5.1	9.6	18.1
4.0 RMS(SPECTRA)	5.7	9.9	19.4



RUN 817 -- VOYAGE 33W -- TAPE 153 -- INDEX 5 -- INTERVAL 17



RUN 817 -- VOYAGE 33W -- TAPE 153 -- INDEX 5 -- INTERVAL 17

LOG BOOK DATA

DATE AND TIME	01-24-74 1200
POSITION	47-33 N 11-56 W
COURSE AND SPEED	247 . 32.2 KNOTS
SEA STATE	4
WAVE HEIGHT	1 FEET
" REL DIR	23 STBD
SWELL HEIGHT	4 FEET
" REL DIR	23 STBD

---- VISUAL WEATHER / COMMENTS ----

SCAT CLOUDS /

MIDSHIP VERTICAL BENDING STRESS

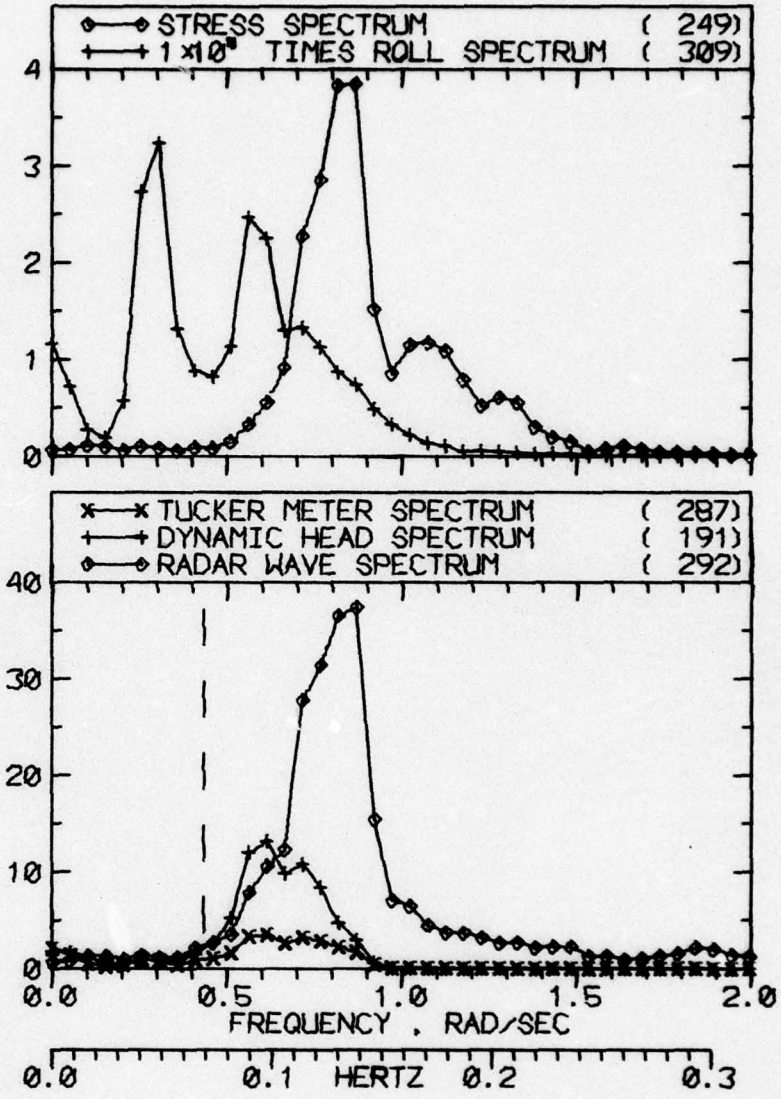
MAXIMUM PK-TR	7.0 KPSI
4.0 X RMS	4.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

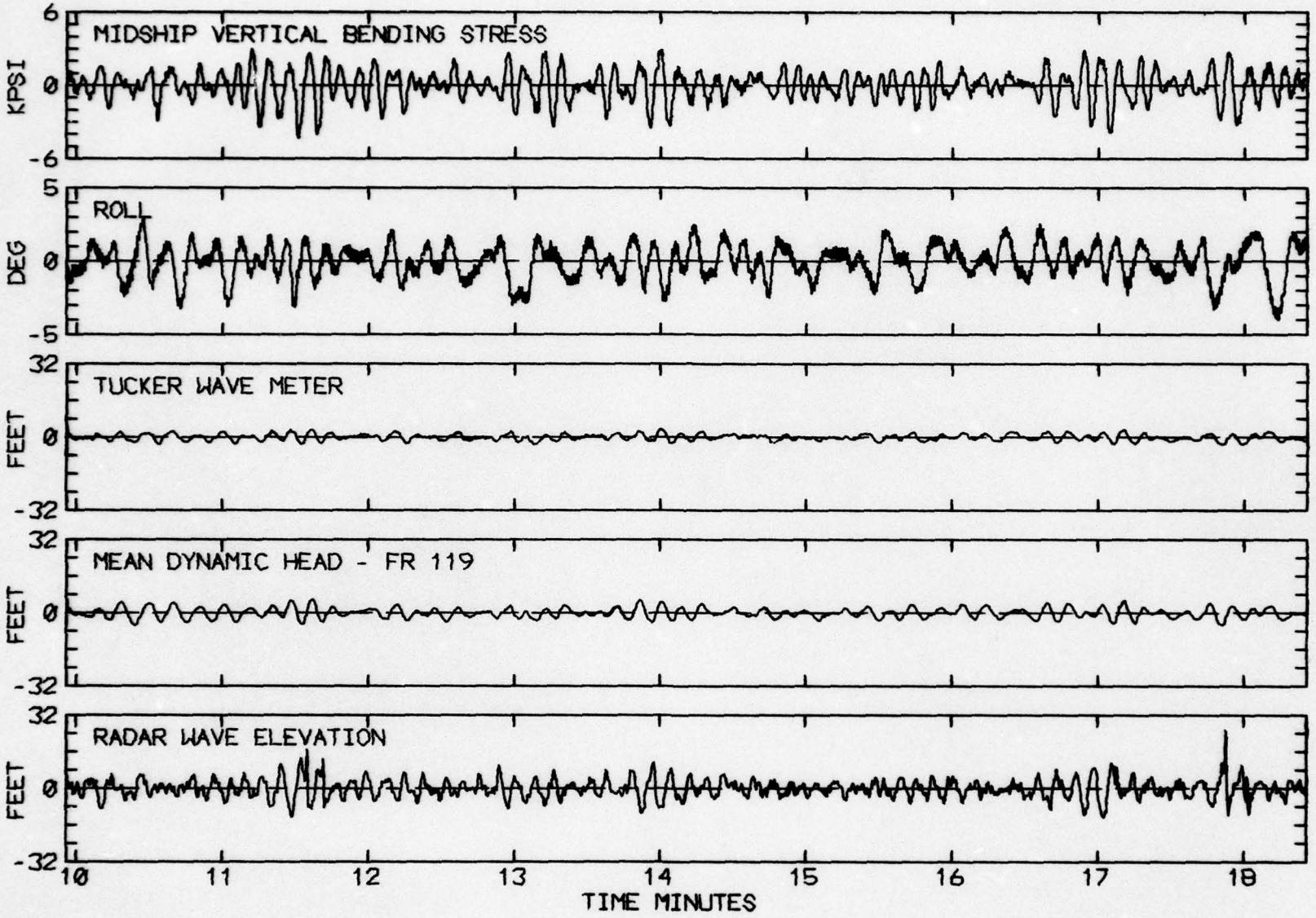
ROLL	4.6 DEG
PITCH	1.49 DEG
DK HSE VERT ACCEL	0.34 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	28.5 FEET
VERTICAL RANGE	27.3 FEET
DISPL AT RADAR	18.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	168	125	228
MAXIMUM HEIGHT	6.2	10.4	38.8
10TH HIGHEST HTS	5.3	9.3	20.0
3RD HIGHEST HTS	4.3	7.5	13.9
4.0 RMS(SPECTRA)	5.1	8.1	15.1



RUN 822 -- VOYAGE 33W -- TAPE 153 -- INDEX 6 -- INTERVAL 22



RUN 822 -- VOYAGE 33W -- TAPE 153 -- INDEX 6 -- INTERVAL 22

LOG BOOK DATA

DATE AND TIME	01-24-74 1600
POSITION	47-33 N 11-56 W
COURSE AND SPEED	248 . 33.3 KNOTS
SEA STATE	5
WAVE HEIGHT	2 FEET
" REL DIR	12 PORT
SWELL HEIGHT	4 FEET
" REL DIR	22 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /PITCHING EASILY

MIDSHIP VERTICAL BENDING STRESS

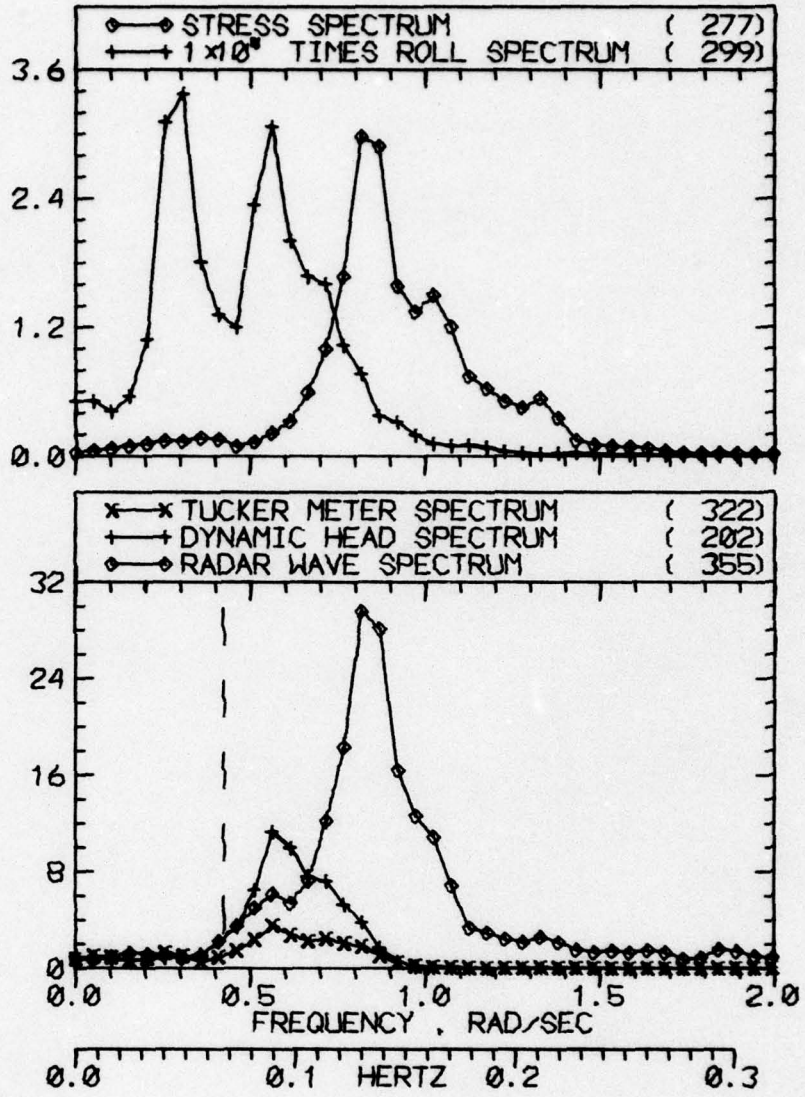
MAXIMUM PK-TR	6.0 KPSI
4.0 X RMS	4.1 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

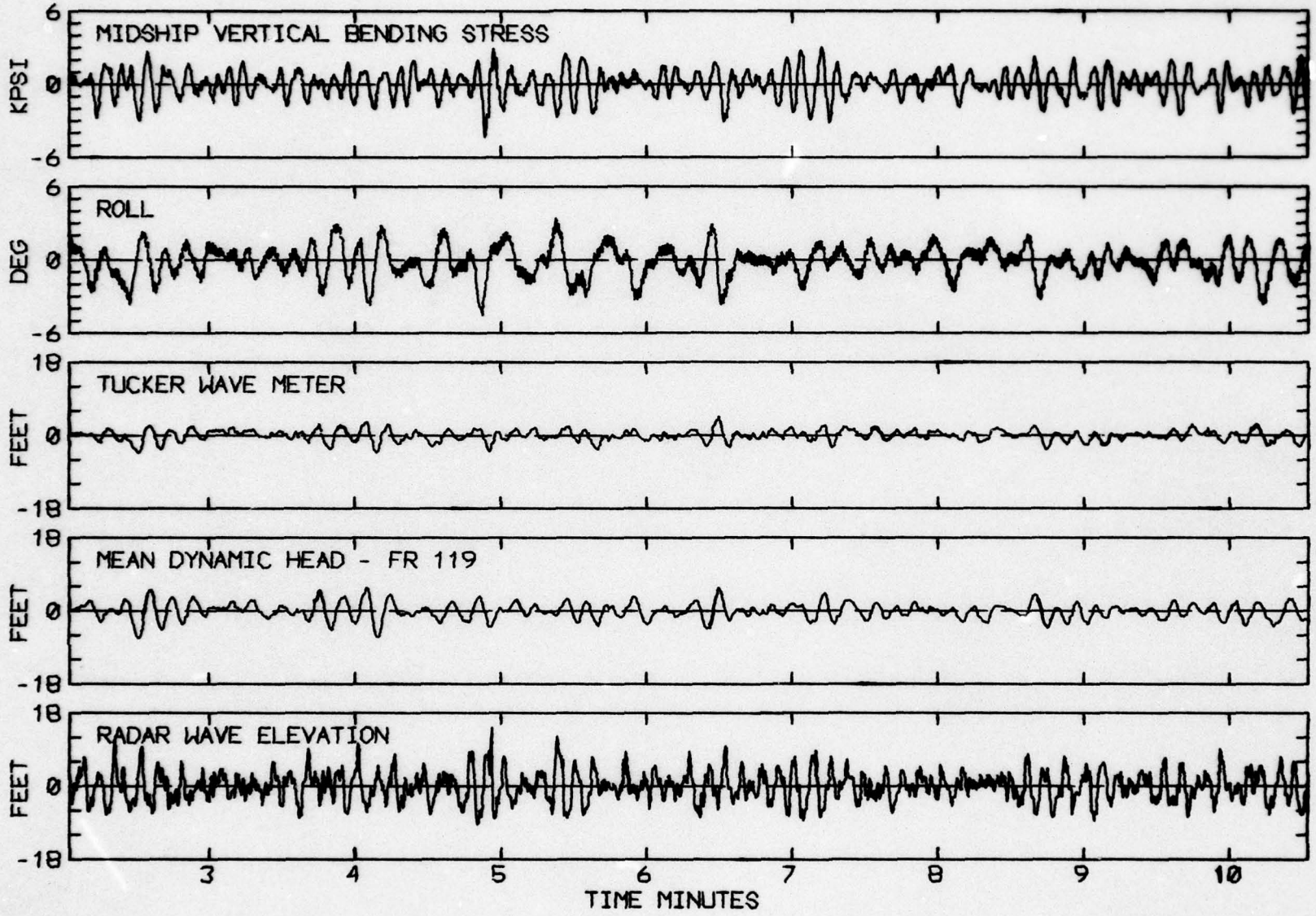
ROLL	4.9 DEG
PITCH	1.34 DEG
DK HSE VERT ACCEL	0.30 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	25.6 FEET
VERTICAL RANGE	24.3 FEET
DISPL AT RADAR	15.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	175	127	251
MAXIMUM HEIGHT	7.7	12.2	22.5
10TH HIGHEST HTS	5.7	8.9	16.1
3RD HIGHEST HTS	4.1	6.9	12.3
4.0 RMS(SPECTRA)	5.0	7.4	13.7



RUN 825 -- VOYAGE 33W -- TAPE 153 -- INDEX 7 -- INTERVAL 25



RUN 825 -- VOYAGE 33W -- TAPE 153 -- INDEX 7 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	01-24-74 2000
POSITION	47-33 N 11-56 W
COURSE AND SPEED	246 . 32.4 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	10 PORT
SWELL HEIGHT	4 FEET
" REL DIR	10 PORT

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

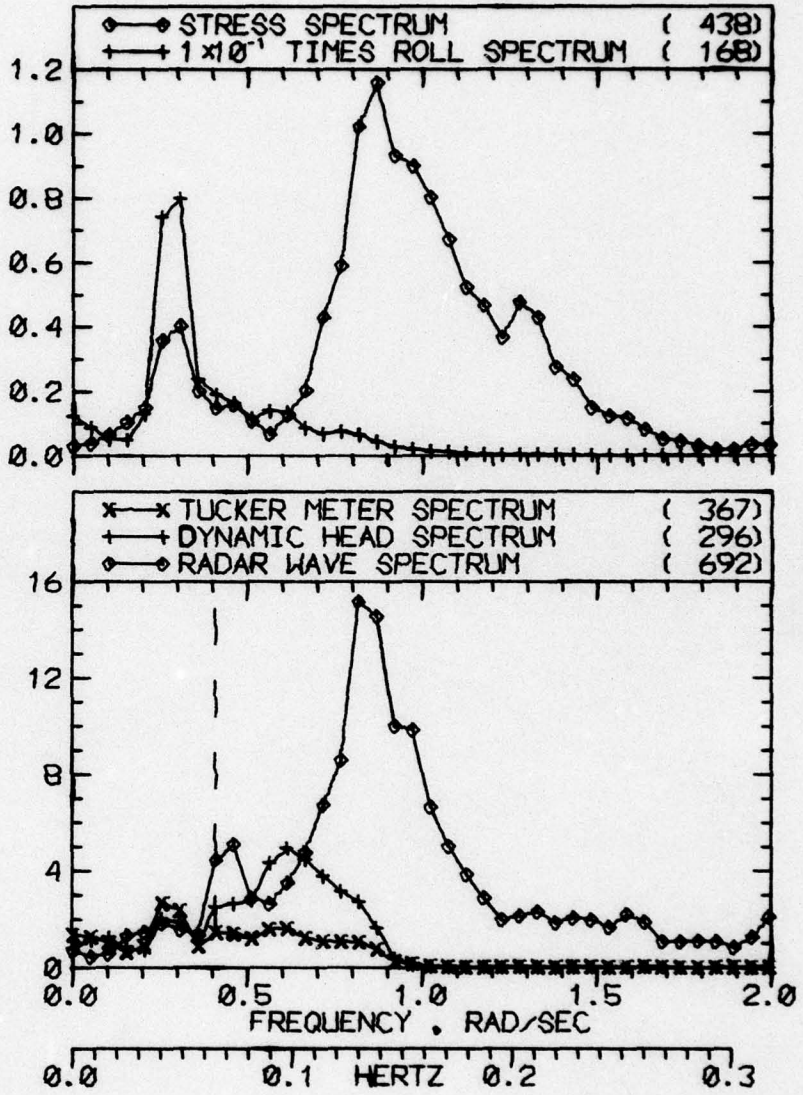
MAXIMUM PK-TR	4.6 KPSI
4.0 X RMS	3.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

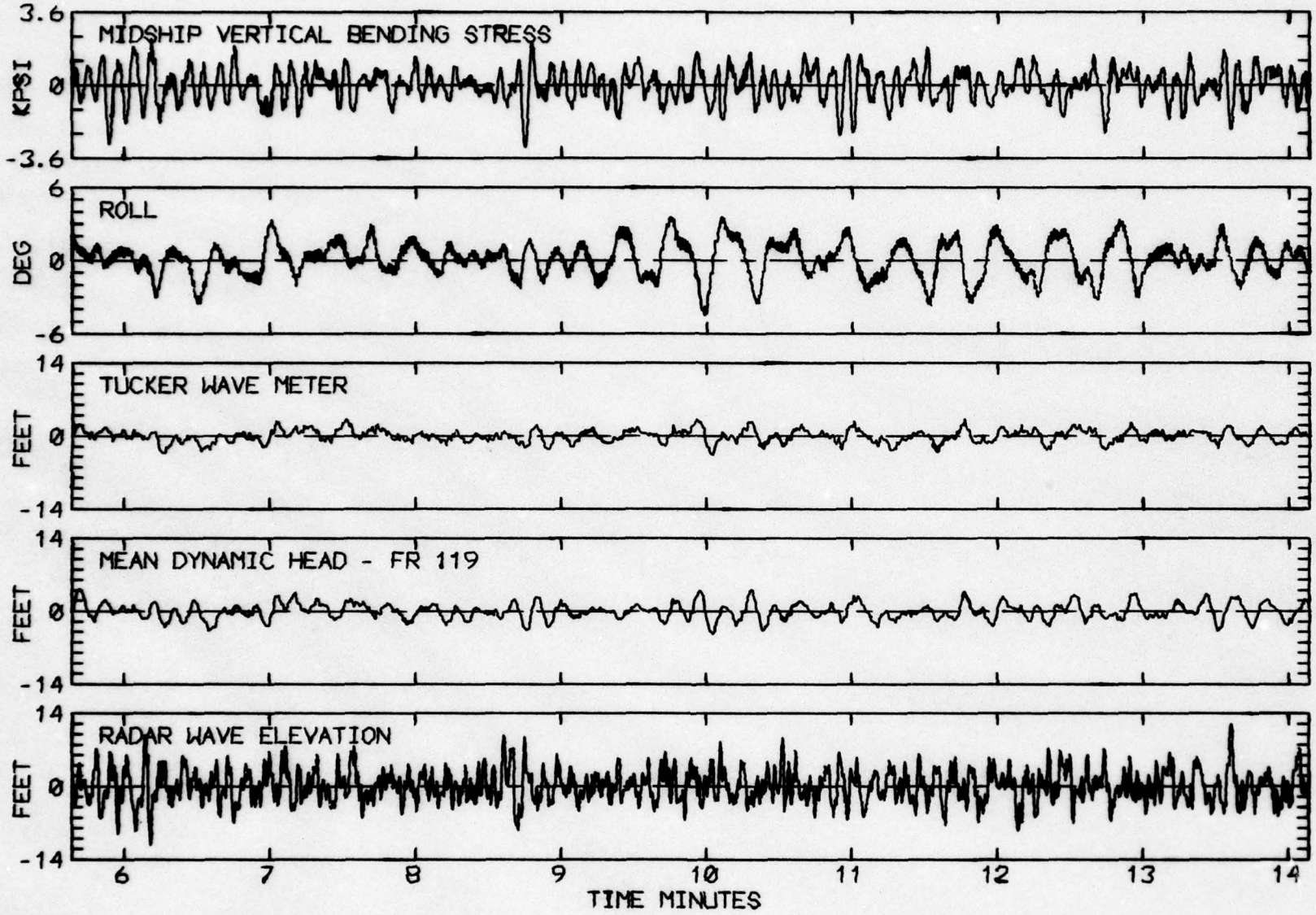
ROLL	5.3 DEG
PITCH	1.04 DEG
DK HSE VERT ACCEL	0.24 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	22.3 FEET
VERTICAL RANGE	19.4 FEET
DISPL AT RADAR	12.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	182	143	336
MAXIMUM HEIGHT	6.6	9.1	21.4
10TH HIGHEST HTS	4.6	6.7	13.6
3RD HIGHEST HTS	3.4	5.1	10.4
4.0 RMS(SPECTRA)	4.6	6.0	12.5



RUN 829 -- VOYAGE 33W -- TAPE 153 -- INDEX 8 -- INTERVAL 29



RUN 829 -- VOYAGE 33W -- TAPE 153 -- INDEX 8 -- INTERVAL 29

LOG BOOK DATA

DATE AND TIME	01-24-74 2400
POSITION	47-33 N 11-56 W
COURSE AND SPEED	246 . 31.9 KNOTS
SEA STATE	6
WAVE HEIGHT	3 FEET
" REL DIR	24 STBD
SWELL HEIGHT	4 FEET
" REL DIR	24 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

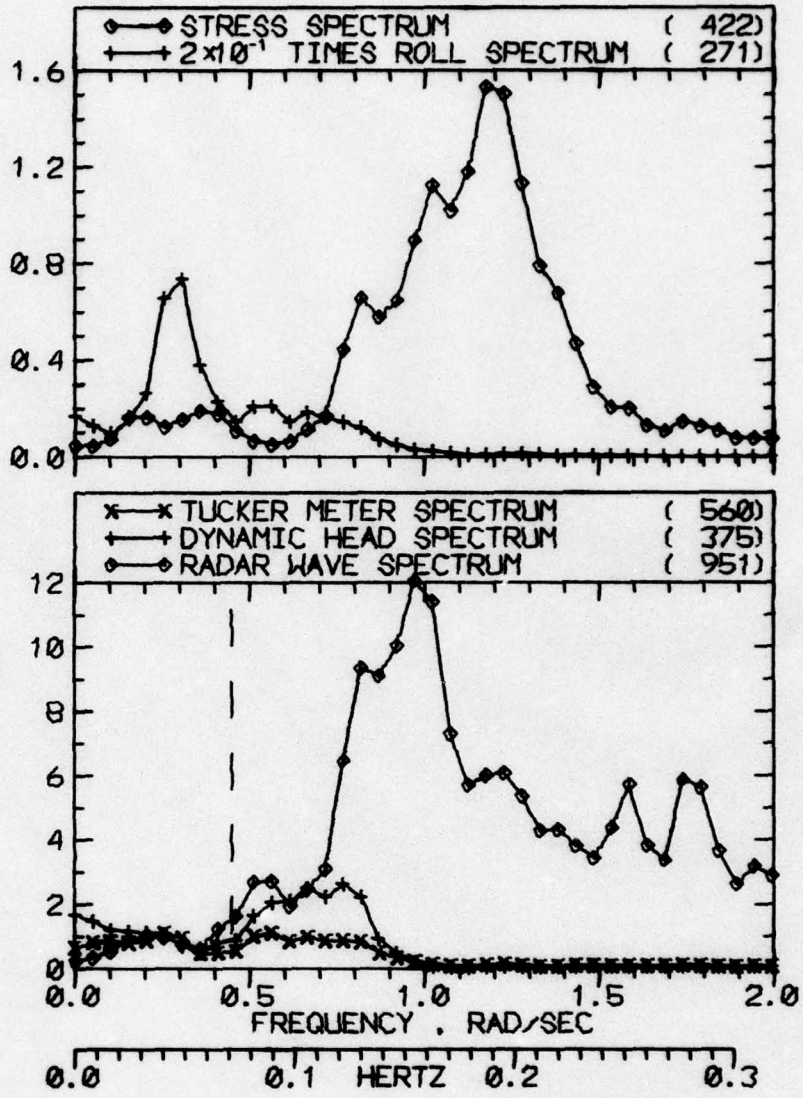
MAXIMUM PK-TR	5.0 KPSI
4.0 X RMS	3.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

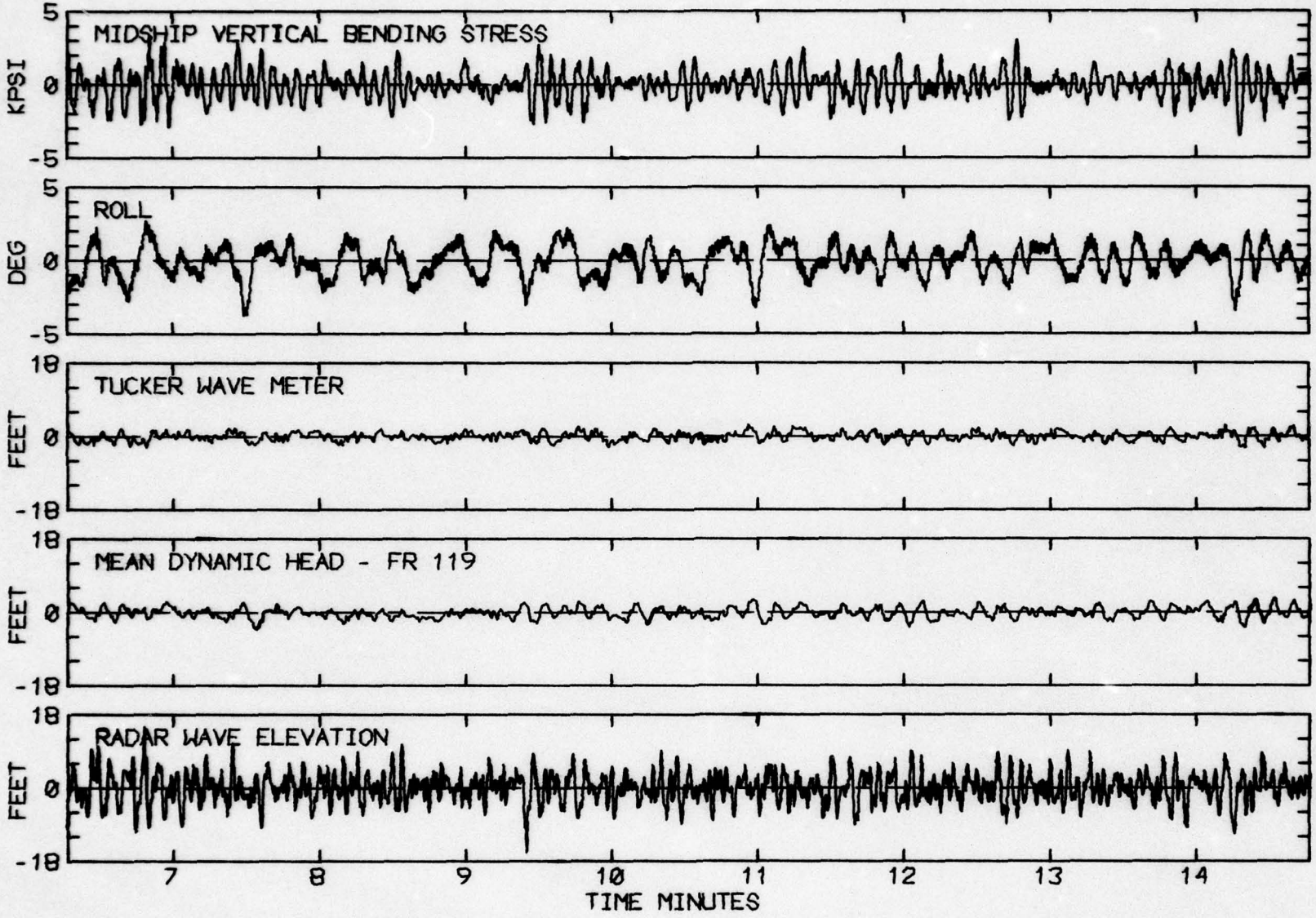
ROLL	4.3 DEG
PITCH	1.05 DEG
DK HSE VERT ACCEL	0.23 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	21.6 FEET
VERTICAL RANGE	19.4 FEET
DISPL AT RADAR	10.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	253	173	381
MAXIMUM HEIGHT	4.9	6.5	24.6
10TH HIGHEST HTS	3.9	5.2	16.0
3RD HIGHEST HTS	2.9	4.0	12.0
4.0 RMS(SPECTRA)	3.9	4.9	13.8



RUN 833 -- VOYAGE 33W -- TAPE 153 -- INDEX 9 -- INTERVAL 33



RUN B33 -- VOYAGE 33W -- TAPE 153 -- INDEX 9 -- INTERVAL 33

LOG BOOK DATA

DATE AND TIME	01-25-74 0400
POSITION	47-33 N 11-56 W
COURSE AND SPEED	246 . 32.1 KNOTS
SEA STATE	6
WAVE HEIGHT	5 FEET
" REL DIR	1 STBD
SWELL HEIGHT	6 FEET
" REL DIR	1 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /PITCHING MODERATELY

MIDSHIP VERTICAL BENDING STRESS

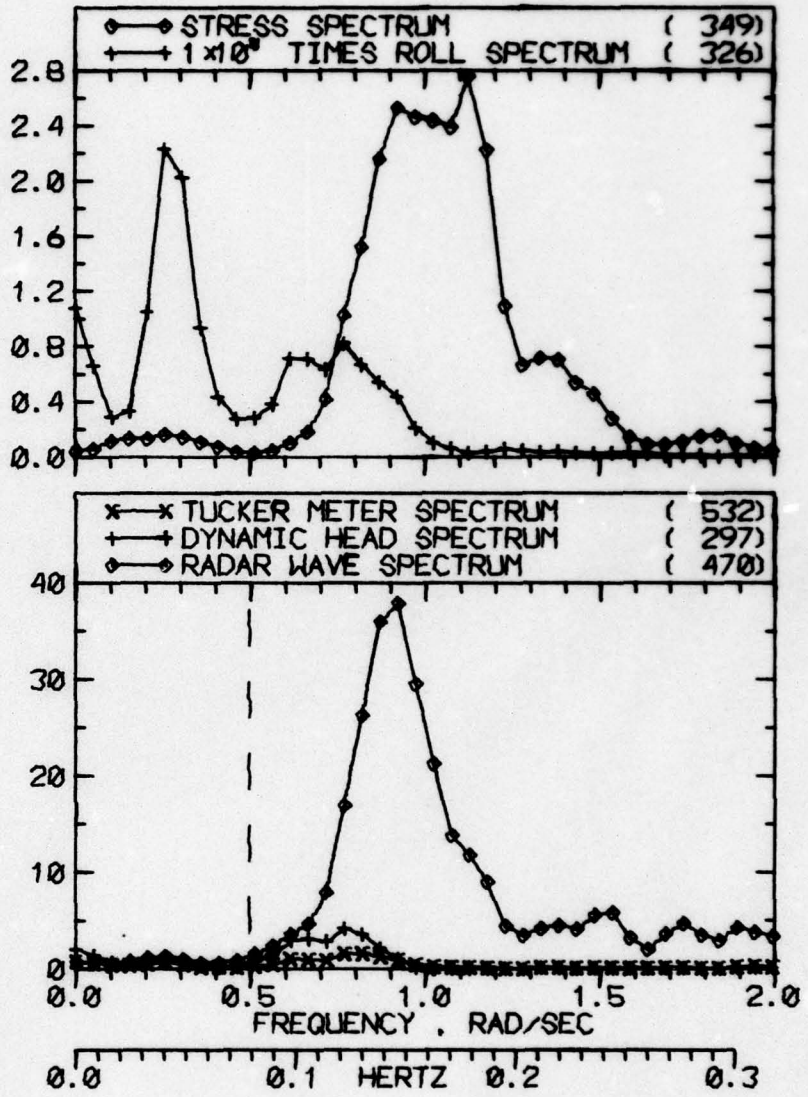
MAXIMUM PK-TR	6.5 KPSI
4.0 X RMS	4.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

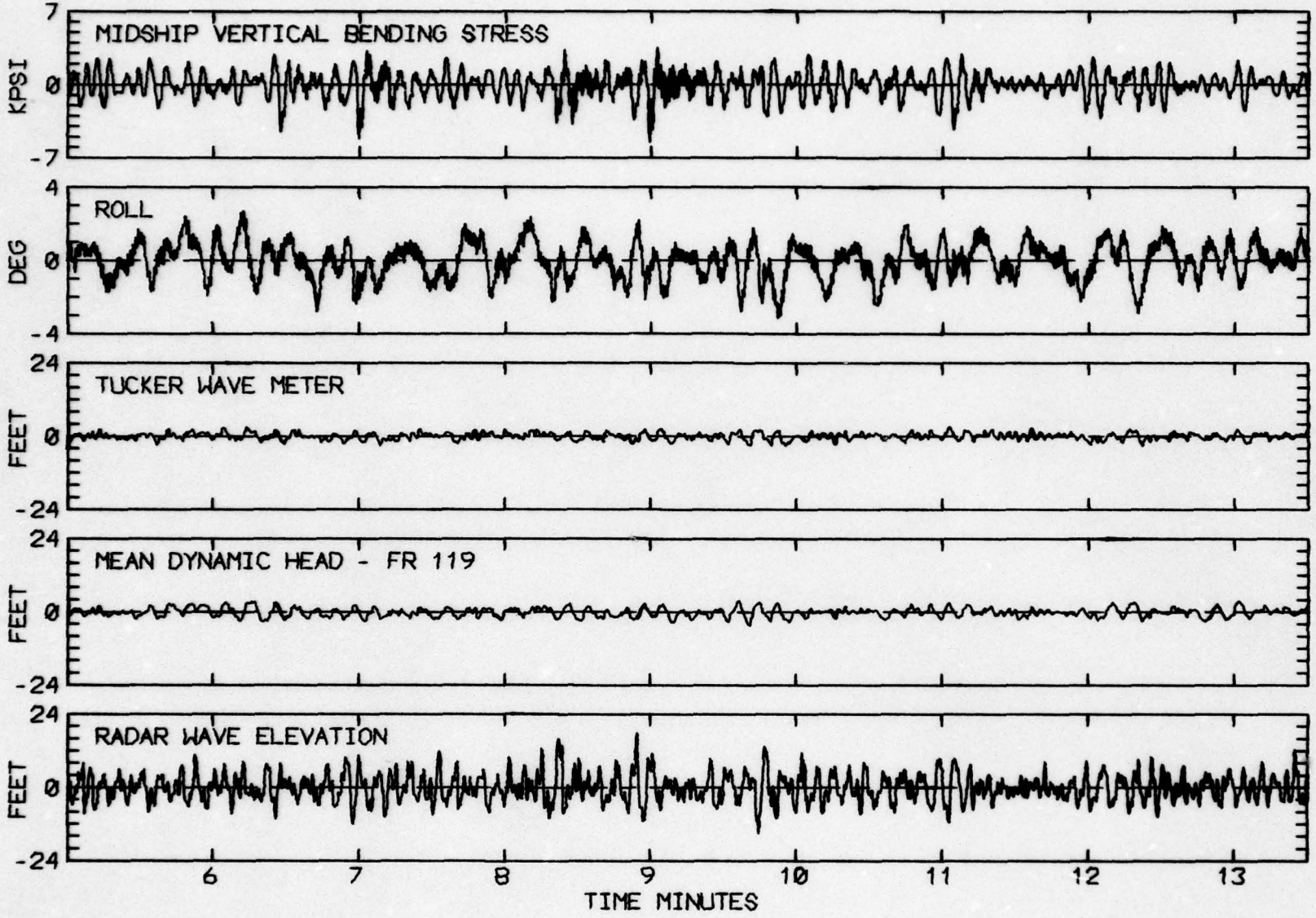
ROLL	3.7 DEG
PITCH	1.53 DEG
DK HSE VERT ACCEL	0.34 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	29.3 FEET
VERTICAL RANGE	27.6 FEET
DISPL AT RADAR	14.3 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	256	187	292
MAXIMUM HEIGHT	5.3	7.9	28.9
10TH HIGHEST HTS	4.3	5.8	20.7
3RD HIGHEST HTS	3.3	4.5	16.0
4.0 RMS(SPECTRA)	4.0	5.2	17.5



RUN 837 -- VOYAGE 33W -- TAPE 153 -- INDEX 10 -- INTERVAL 37



RUN 837 -- VOYAGE 33W -- TAPE 153 -- INDEX 10 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	01-25-74 0800
POSITION	47-33 N 11-56 W
COURSE AND SPEED	246 . 32.1 KNOTS
SEA STATE	7
WAVE HEIGHT	5 FEET
" REL DIR	21 PORT
SWELL HEIGHT	6 FEET
" REL DIR	21 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

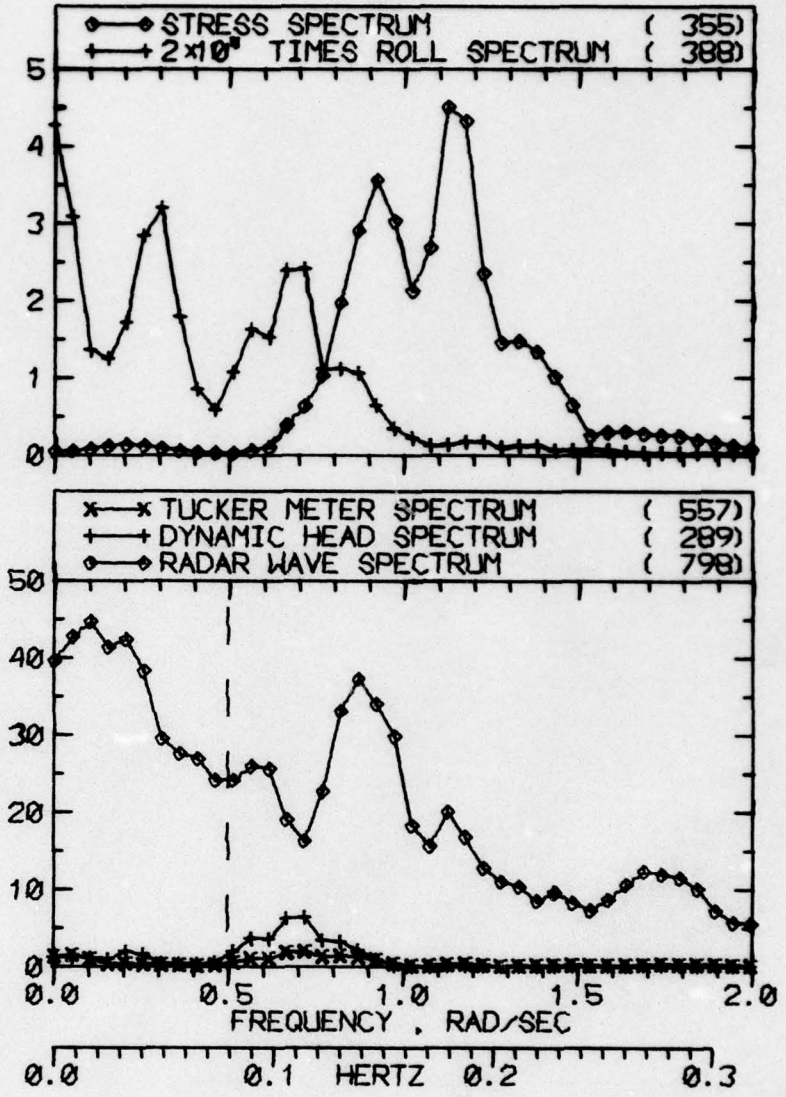
MAXIMUM PK-TR	9.5 KPSI
4.0 X RMS	5.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

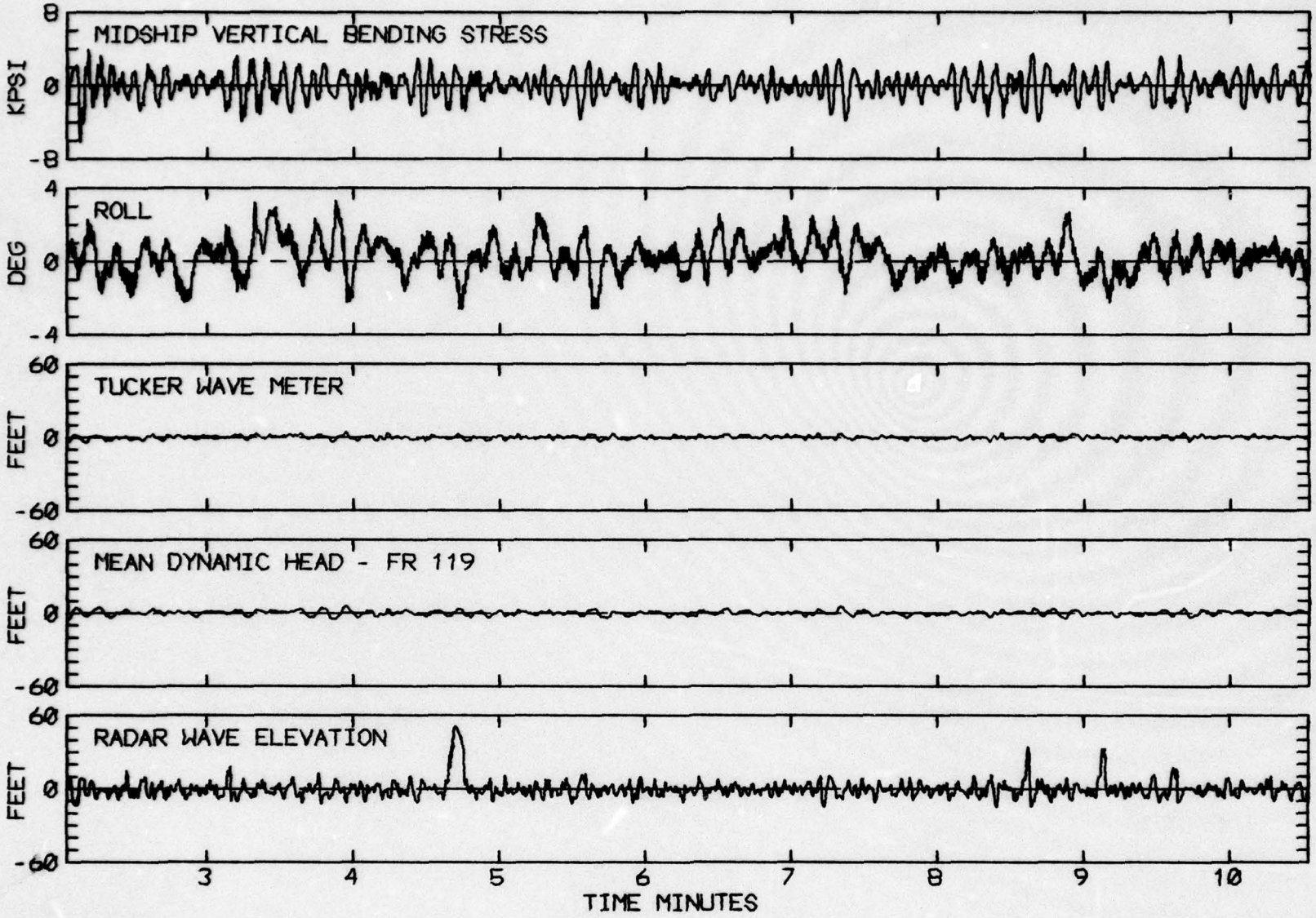
ROLL	3.9 DEG
PITCH	1.54 DEG
DK HSE VERT ACCEL	0.34 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	36.4 FEET
VERTICAL RANGE	34.7 FEET
DISPL AT RADAR	15.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	252	173	281
MAXIMUM HEIGHT	6.5	9.2	53.6
10TH HIGHEST HTS	5.2	7.4	30.0
3RD HIGHEST HTS	3.8	5.4	20.3
4.0 RMS(SPECTRA)	4.6	6.2	28.1



RUN 841 -- VOYAGE 33W -- TAPE 153 -- INDEX 11 -- INTERVAL 41



RUN 841 -- VOYAGE 33W -- TAPE 153 -- INDEX 11 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	01-25-74 1200
POSITION	42-51 N 28-27 W
COURSE AND SPEED	265 . 31.8 KNOTS
SEA STATE	8
WAVE HEIGHT	8 FEET
" REL DIR	5 STBD
SWELL HEIGHT	6 FEET
" REL DIR	5 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

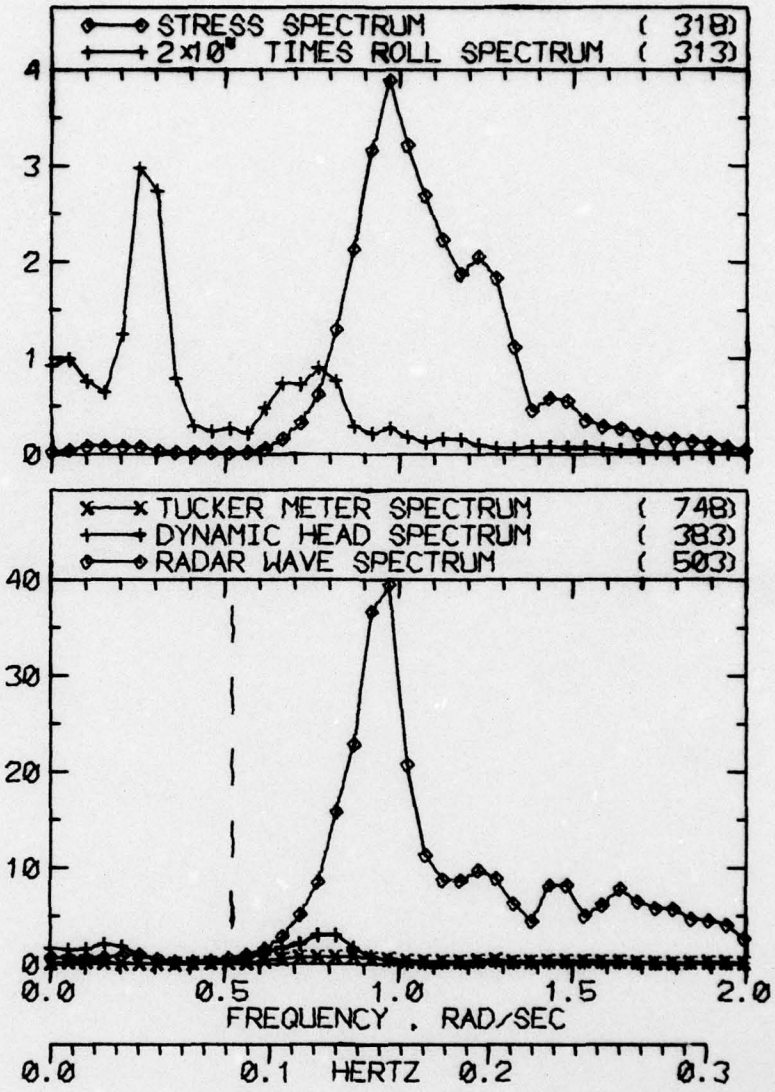
MAXIMUM PK-TR	8.3 KPSI
4.0 X RMS	5.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

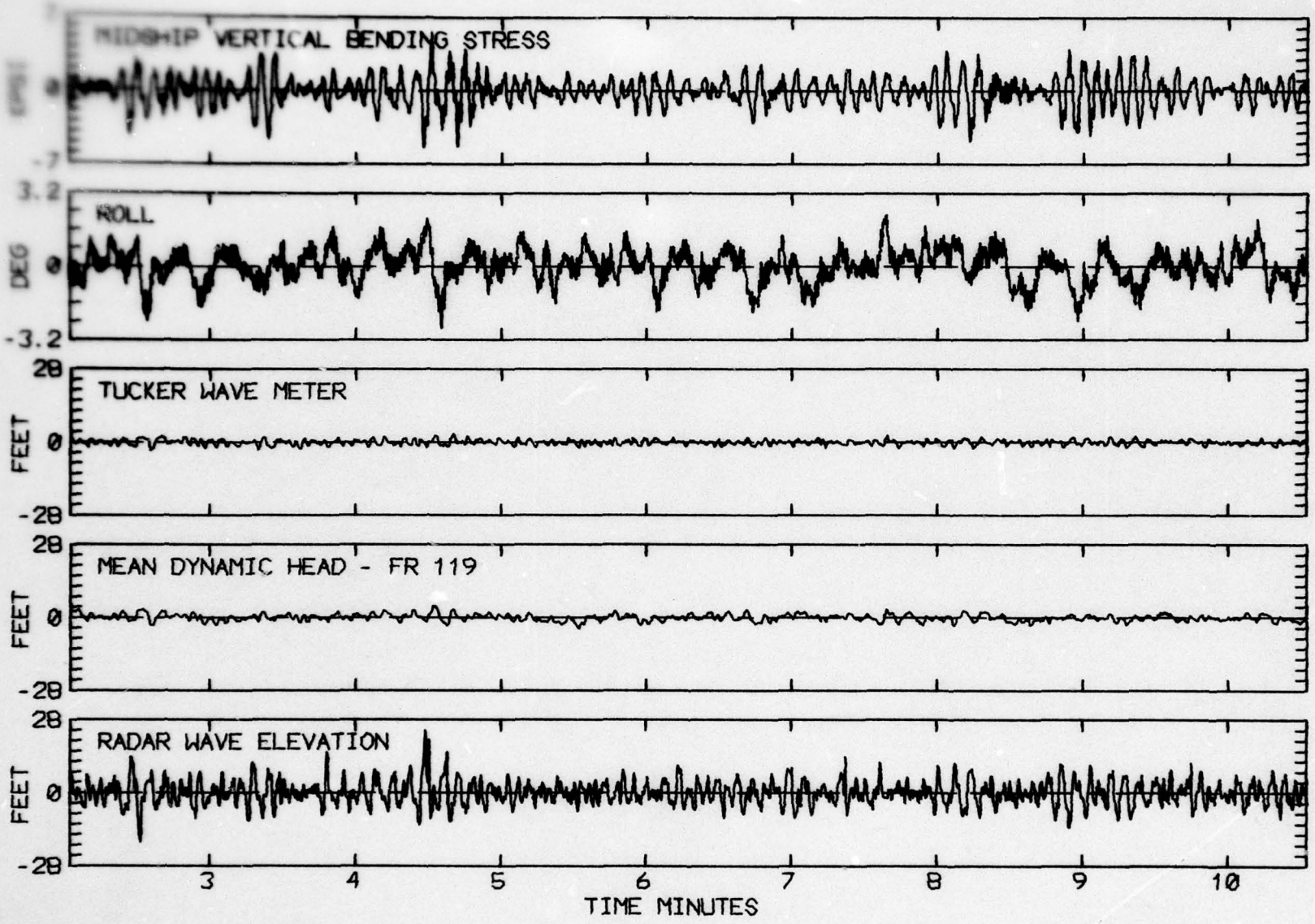
ROLL	2.9 DEG
PITCH	1.35 DEG
DK HSE VERT ACCEL	0.30 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	26.6 FEET
VERTICAL RANGE	25.7 FEET
DISPL AT RADAR	12.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	316	183	330
MAXIMUM HEIGHT	5.2	7.5	33.7
10TH HIGHEST HTS	3.6	5.3	20.6
3RD HIGHEST HTS	2.9	4.1	15.8
4.0 RMS(SPECTRA)	3.4	4.9	17.3



RUN 845 -- VOYAGE 33W -- TAPE 153 -- INDEX 12 -- INTERVAL 45



RUN 845 -- VOYAGE 33W -- TAPE 153 -- INDEX 12 -- INTERVAL 45

LOG BOOK DATA

DATE AND TIME	01-25-74 1410
POSITION	42-51 N 28-27 W
COURSE AND SPEED	266 . 31.8 KNOTS
SEA STATE	9
WAVE HEIGHT	8 FEET
" REL DIR	4 STBD
SWELL HEIGHT	10 FEET
" REL DIR	4 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /MANUAL OPERATION HIGH WINDS

MIDSHIP VERTICAL BENDING STRESS

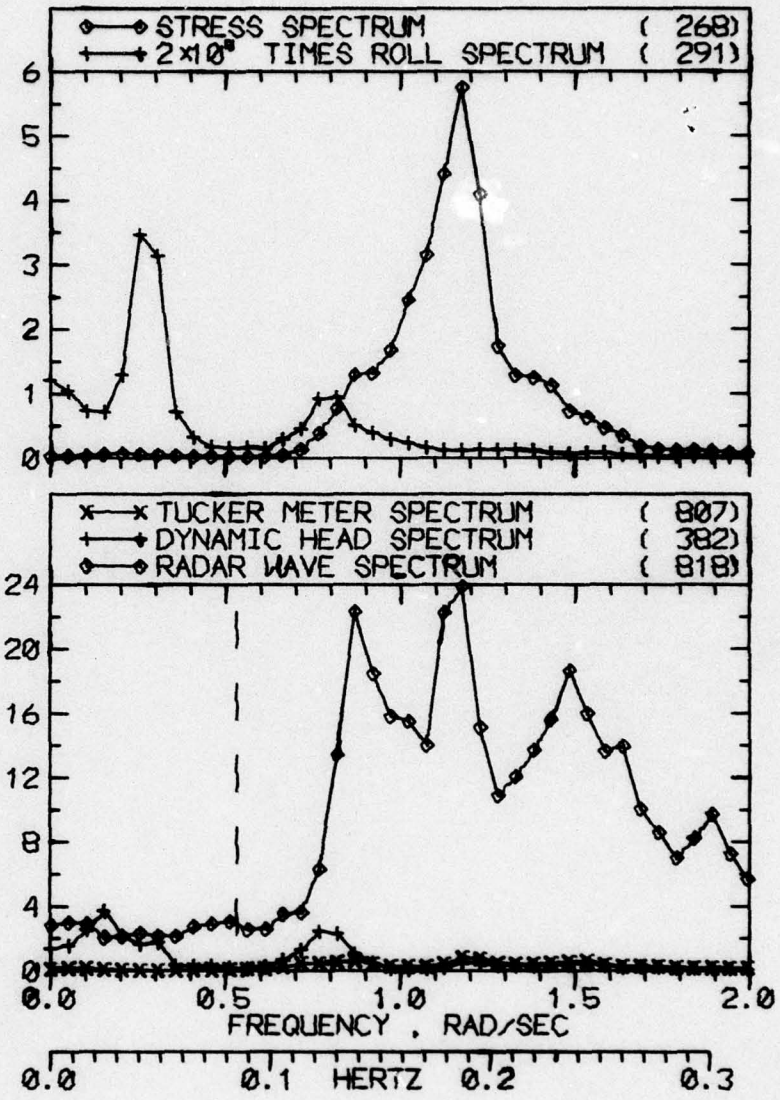
MAXIMUM PK-TR	7.4 KPSI
4.0 X RMS	5.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

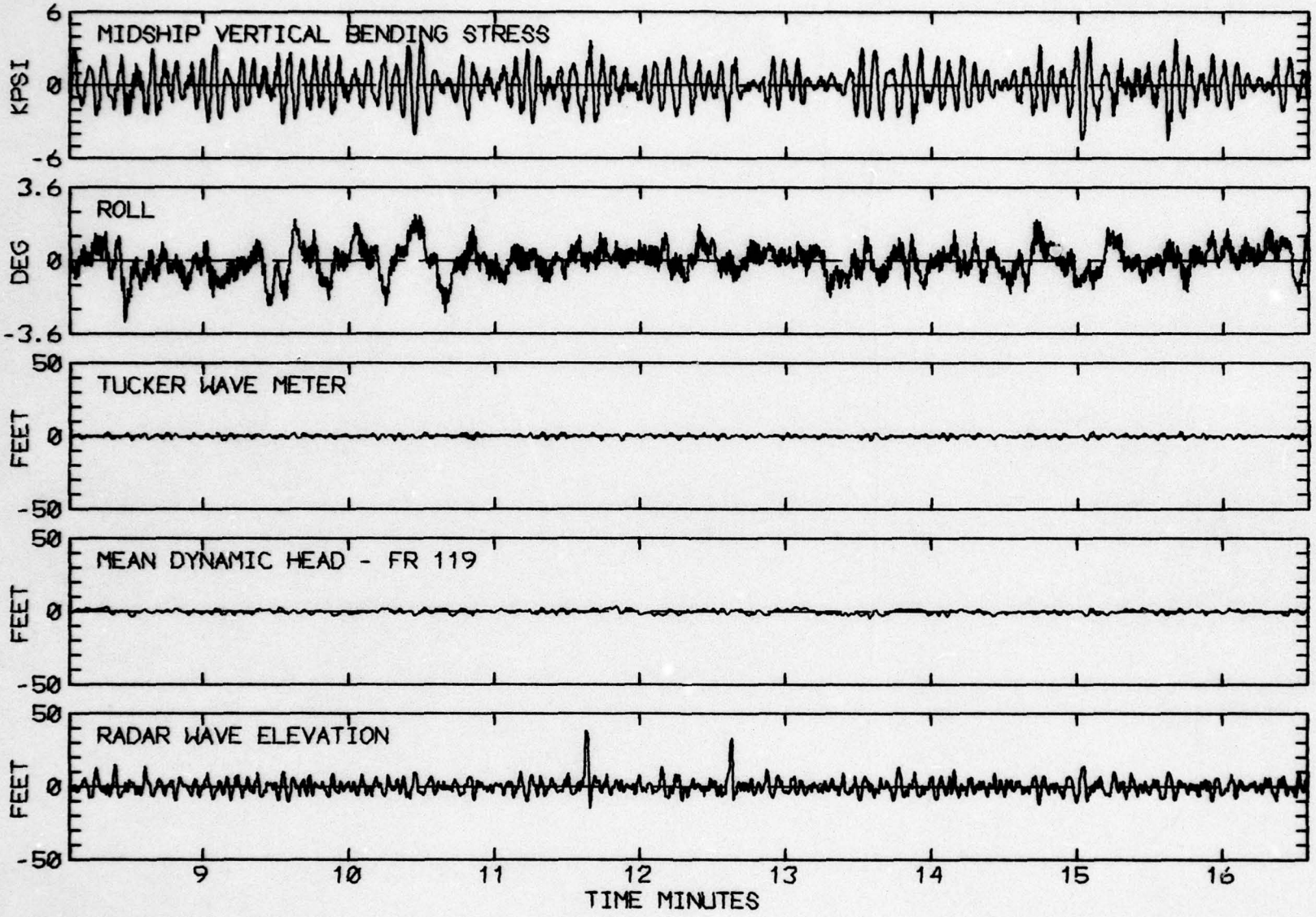
ROLL	3.0 DEG
PITCH	1.30 DEG
DK HSE VERT ACCEL	0.26 G
DK HSE LAT ACCEL	0.09 G
RADAR SLANT RANGE	26.9 FEET
VERTICAL RANGE	24.9 FEET
DISPL AT RADAR	9.7 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	332	179	308
MAXIMUM HEIGHT	4.5	7.0	53.9
10TH HIGHEST HTS	3.7	5.0	23.6
3RD HIGHEST HTS	3.0	3.9	17.5
4.0 RMS(SPECTRA)	3.5	5.1	19.7



RUN 849 -- VOYAGE 33W -- TAPE 153 -- INDEX 13 -- INTERVAL 49



RUN 849 -- VOYAGE 33W -- TAPE 153 -- INDEX 13 -- INTERVAL 49

LOG BOOK DATA

DATE AND TIME	01-25-74 1620
POSITION	42-51 N 28-27 W
COURSE AND SPEED	266 . 31.8 KNOTS
SEA STATE	9
WAVE HEIGHT	12 FEET
" REL DIR	49 STBD
SWELL HEIGHT	10 FEET
" REL DIR	4 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /MORE VERT BENDING ACTION

MIDSHIP VERTICAL BENDING STRESS

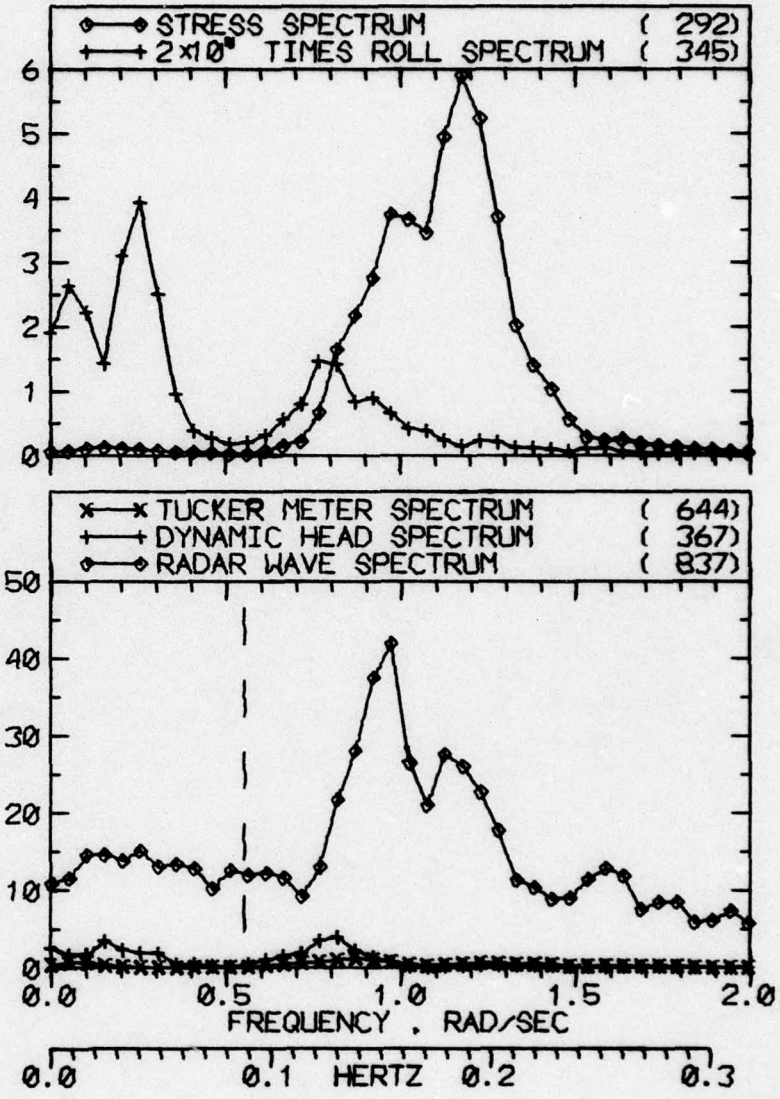
MAXIMUM PK-TR	10.0 KPSI
4.0 X RMS	6.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

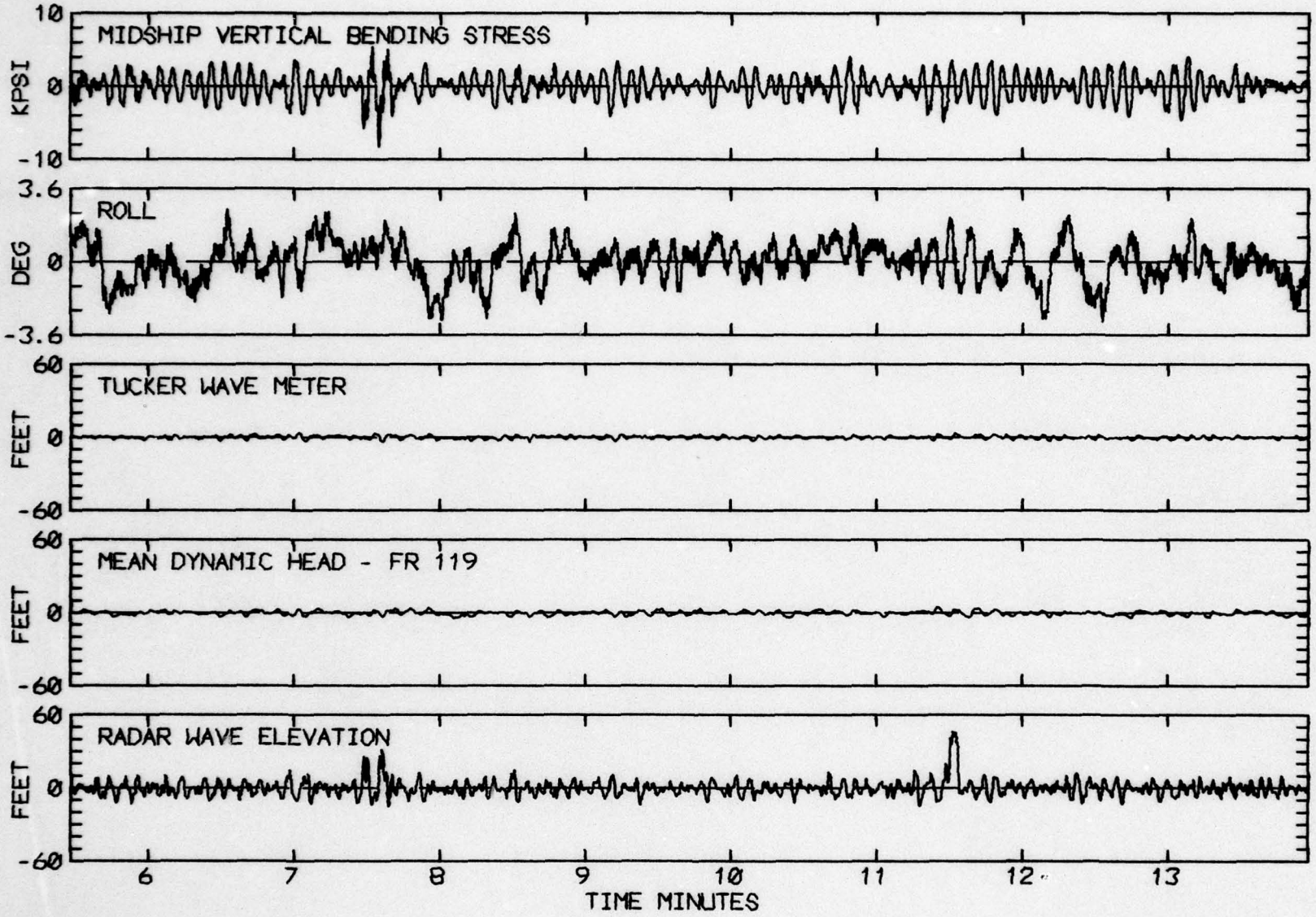
ROLL	3.6 DEG
PITCH	1.60 DEG
DK HSE VERT ACCEL	0.35 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	32.7 FEET
VERTICAL RANGE	31.6 FEET
DISPL AT RADAR	13.8 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	295	186	312
MAXIMUM HEIGHT	5.9	7.4	53.0
10TH HIGHEST HTS	4.1	5.5	28.5
3RD HIGHEST HTS	3.2	4.3	20.0
4.0 RMS(SPECTRA)	3.8	5.5	24.0



RUN 853 -- VOYAGE 33W -- TAPE 153 -- INDEX 14 -- INTERVAL 53



RUN 853 -- VOYAGE 33W -- TAPE 153 -- INDEX 14 -- INTERVAL 53

LOG BOOK DATA

DATE AND TIME	01-25-74 2040
POSITION	42-51 N 28-27 W
COURSE AND SPEED	266 . 32.0 KNOTS
SEA STATE	9
WAVE HEIGHT	12 FEET
" REL DIR	26 STBD
SWELL HEIGHT	12 FEET
" REL DIR	26 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /SHIPPING WATER OVERDECKS

MIDSHIP VERTICAL BENDING STRESS

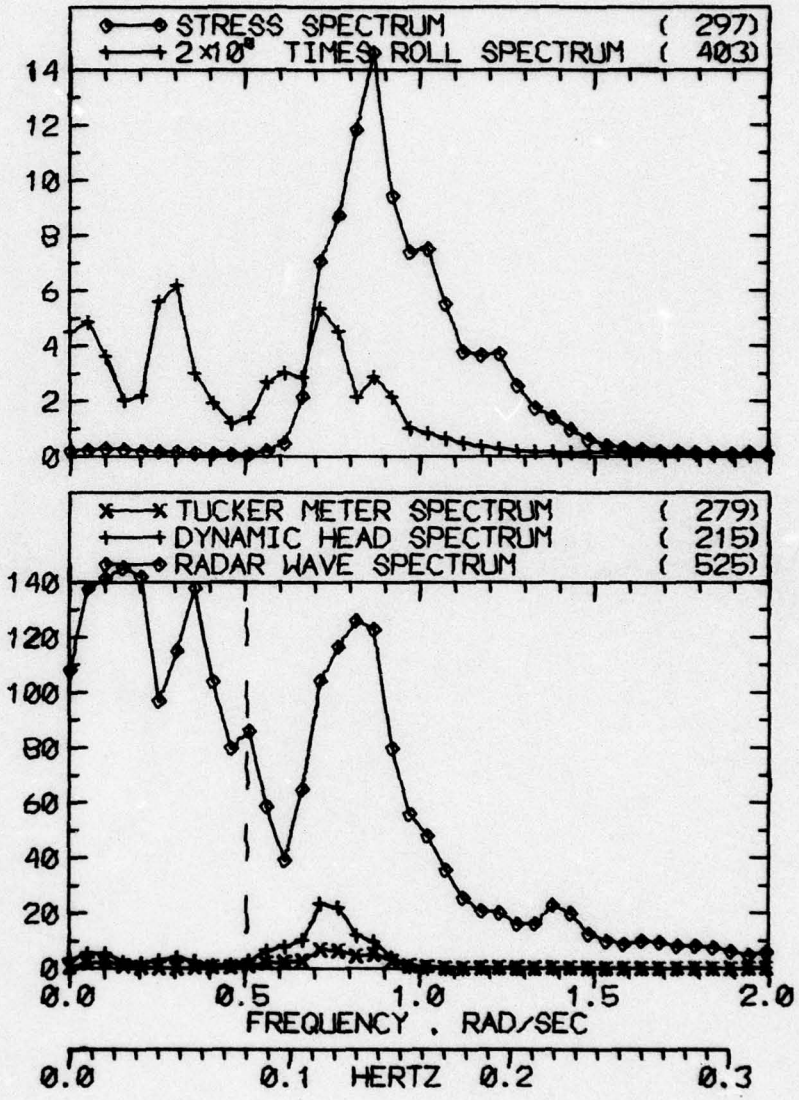
MAXIMUM PK-TR	17.4 KPSI
4.0 X RMS	9.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

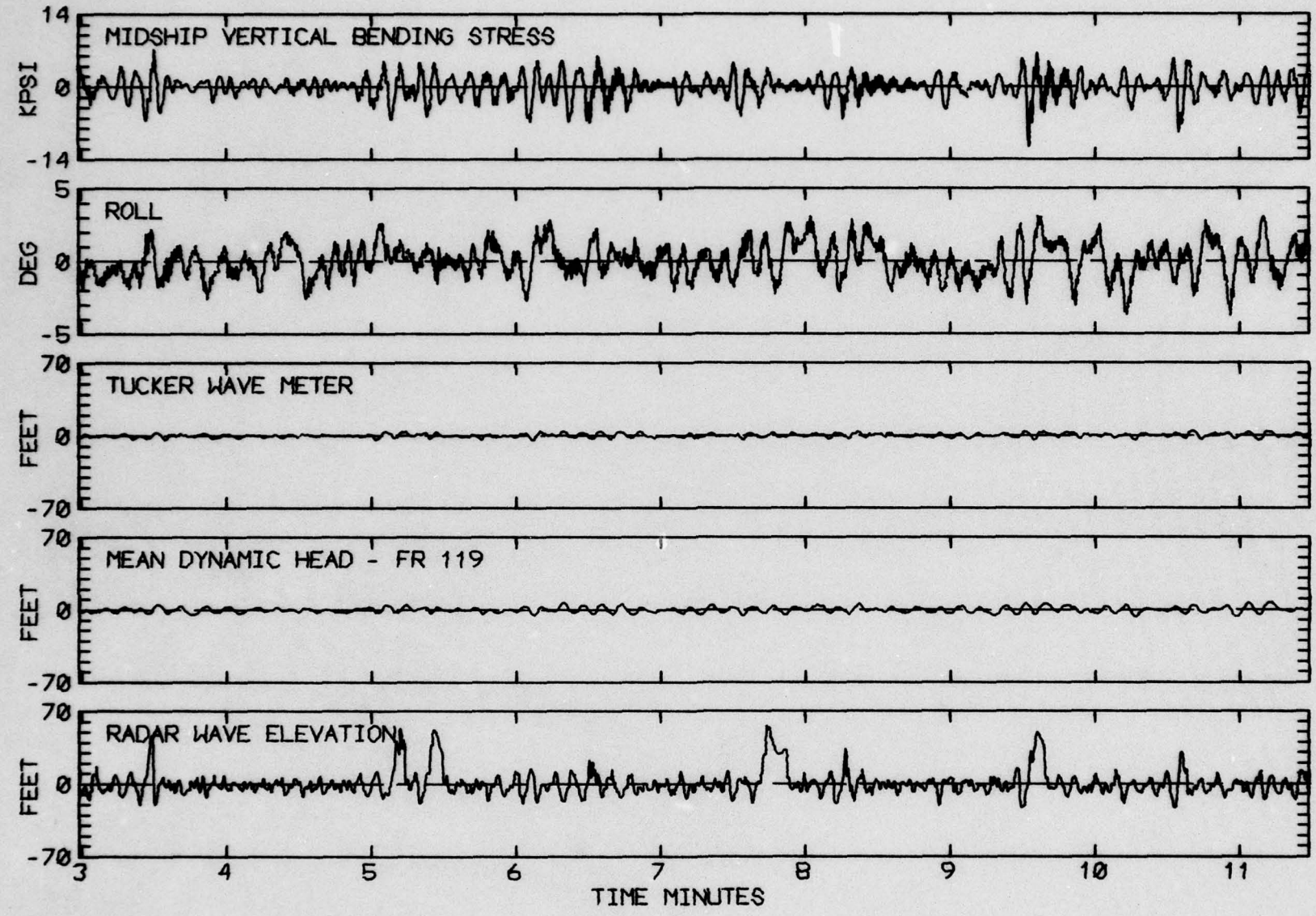
ROLL	5.3 DEG
PITCH	2.43 DEG
DK HSE VERT ACCEL	0.59 G
DK HSE LAT ACCEL	0.16 G
RADAR SLANT RANGE	60.3 FEET
VERTICAL RANGE	57.5 FEET
DISPL AT RADAR	27.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	201	129	207
MAXIMUM HEIGHT	9.4	16.9	70.9
10TH HIGHEST HTS	7.1	12.0	49.0
3RD HIGHEST HTS	5.6	9.4	33.3
4.0 RMS(SPECTRA)	6.4	10.4	45.0



RUN 861 -- VOYAGE 33W -- TAPE 153 -- INDEX 16 -- INTERVAL 61



RUN 861 -- VOYAGE 33W -- TAPE 153 -- INDEX 16 -- INTERVAL 61

LOG BOOK DATA

DATE AND TIME	01-25-74 2400
POSITION	42-51 N 28-27 W
COURSE AND SPEED	266 . 31.2 KNOTS
SEA STATE	5
WAVE HEIGHT	5 FEET
" REL DIR	4 STBD
SWELL HEIGHT	10 FEET
" REL DIR	4 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /WIND DOWN TO 30 MPH

MIDSHIP VERTICAL BENDING STRESS

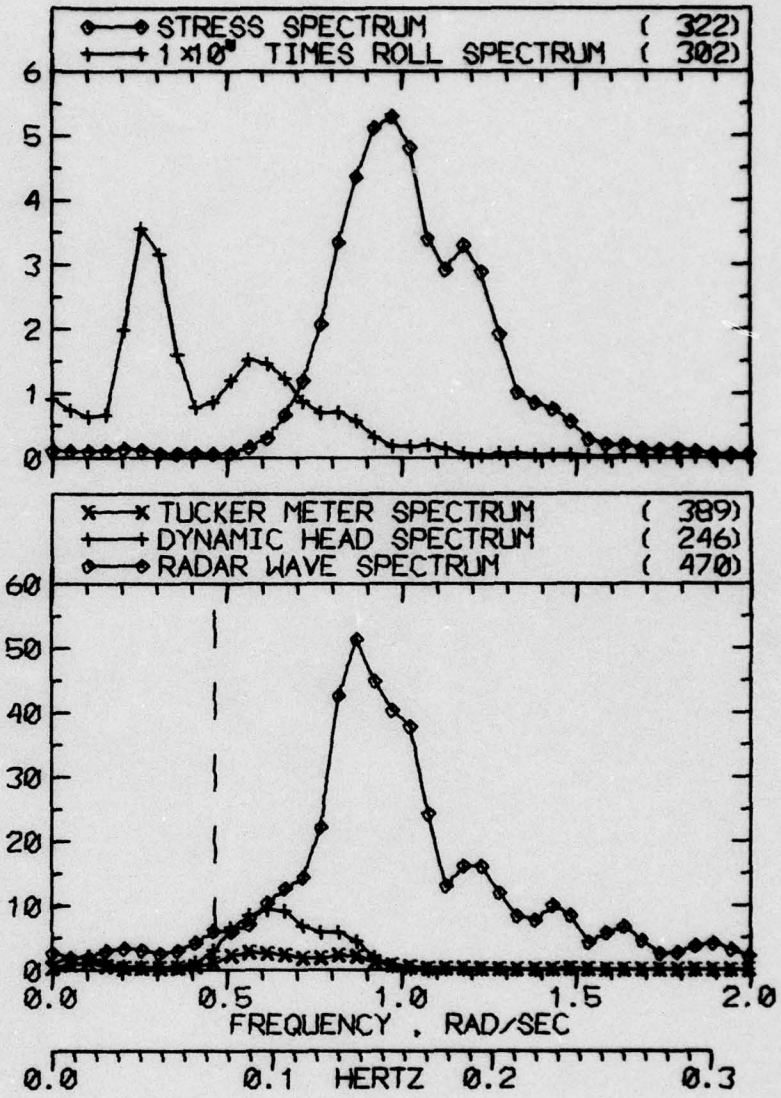
MAXIMUM PK-TR	9.7 KPSI
4.0 X RMS	6.5 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

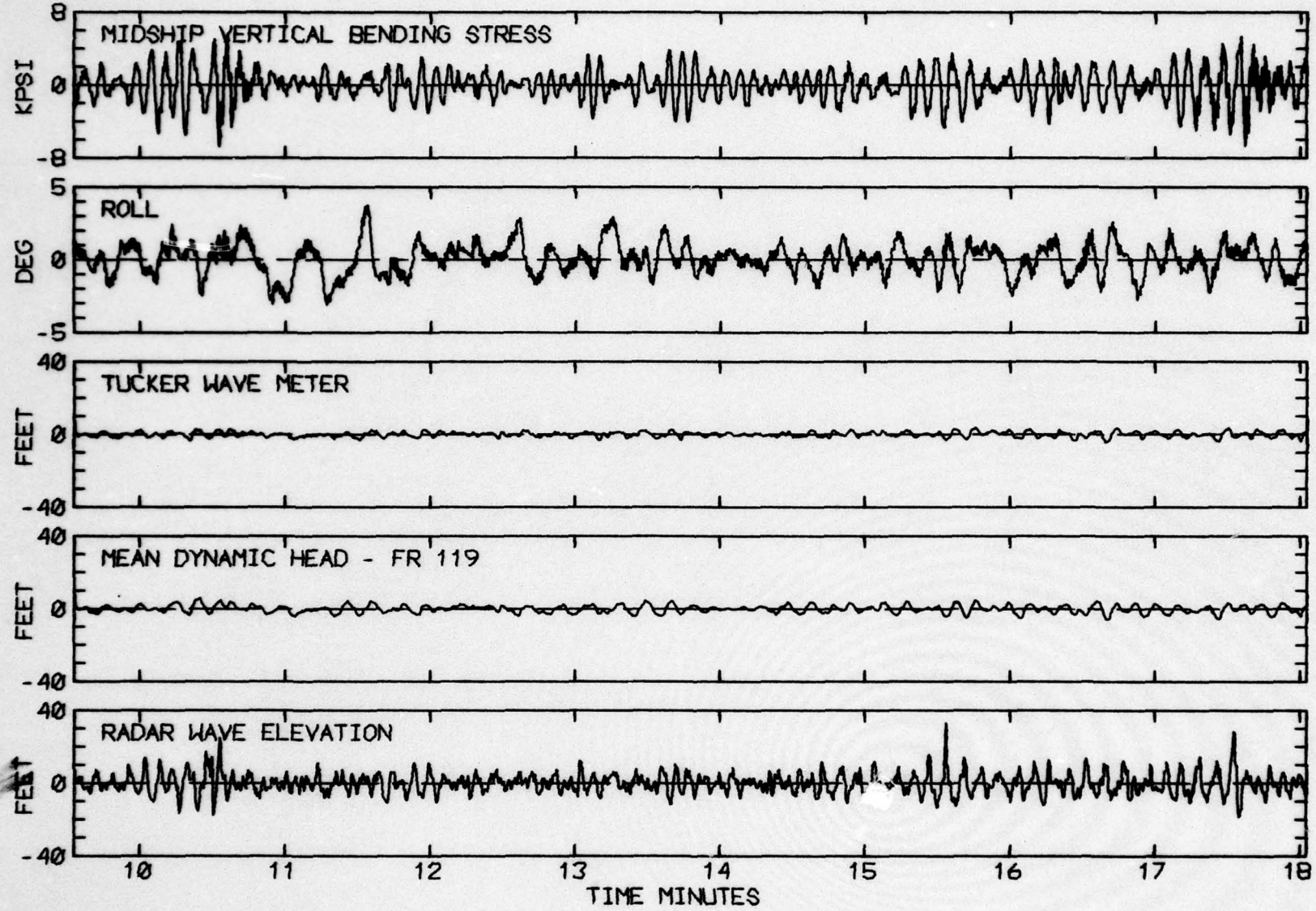
ROLL	4.5 DEG
PITCH	1.59 DEG
DK HSE VERT ACCEL	0.40 G
DK HSE LAT ACCEL	0.14 G
RADAR SLANT RANGE	35.1 FEET
VERTICAL RANGE	33.8 FEET
DISPL AT RADAR	18.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	198	140	256
MAXIMUM HEIGHT	6.5	9.7	48.2
10TH HIGHEST HTS	5.5	8.6	27.4
3RD HIGHEST HTS	4.3	7.2	20.0
4.0 RMS(SPECTRA)	5.1	7.8	21.1



RUN 901 -- VOYAGE 33W -- TAPE 155 -- INDEX 17 -- INTERVAL 1



RUN 901 -- VOYAGE 33W -- TAPE 155 -- INDEX 17 -- INTERVAL 1

LOG BOOK DATA

DATE AND TIME	01-26-74 0400
POSITION	42-51 N 28-27 W
COURSE AND SPEED	266 . 31.8 KNOTS
SEA STATE	4
WAVE HEIGHT	5 FEET
" REL DIR	4 STBD
SWELL HEIGHT	8 FEET
" REL DIR	4 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

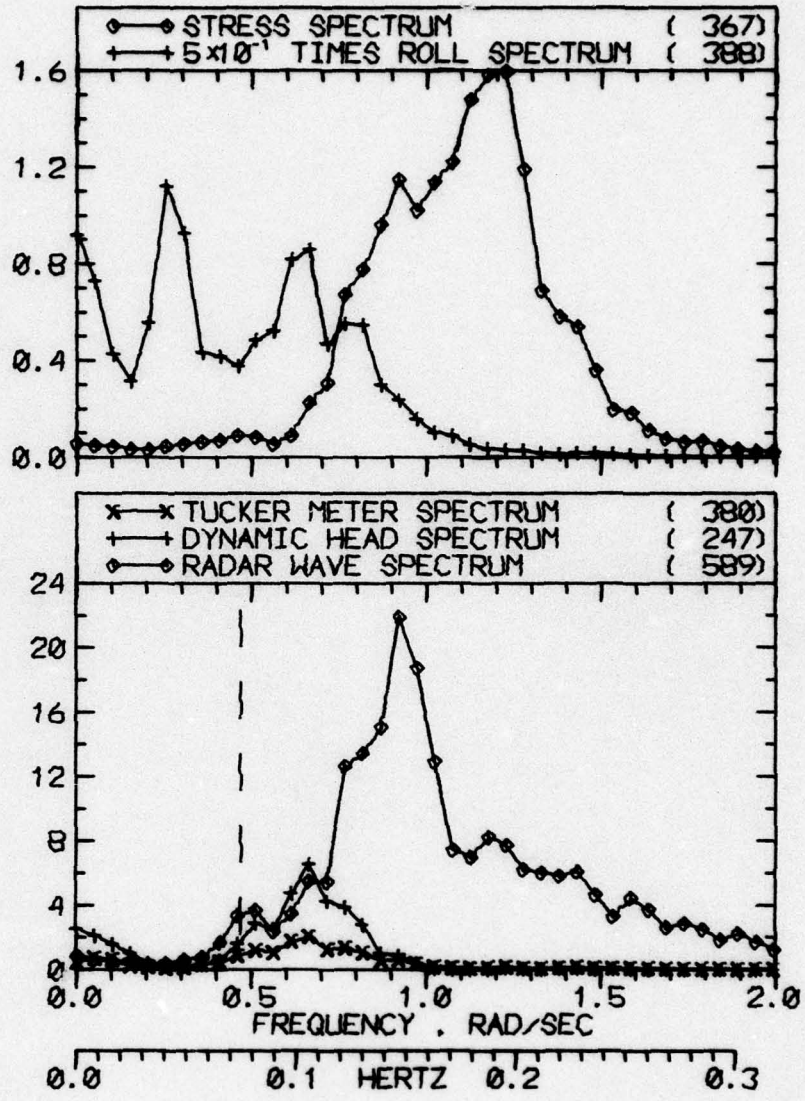
MAXIMUM PK-TR	5.5 KPSI
4.0 X RMS	3.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

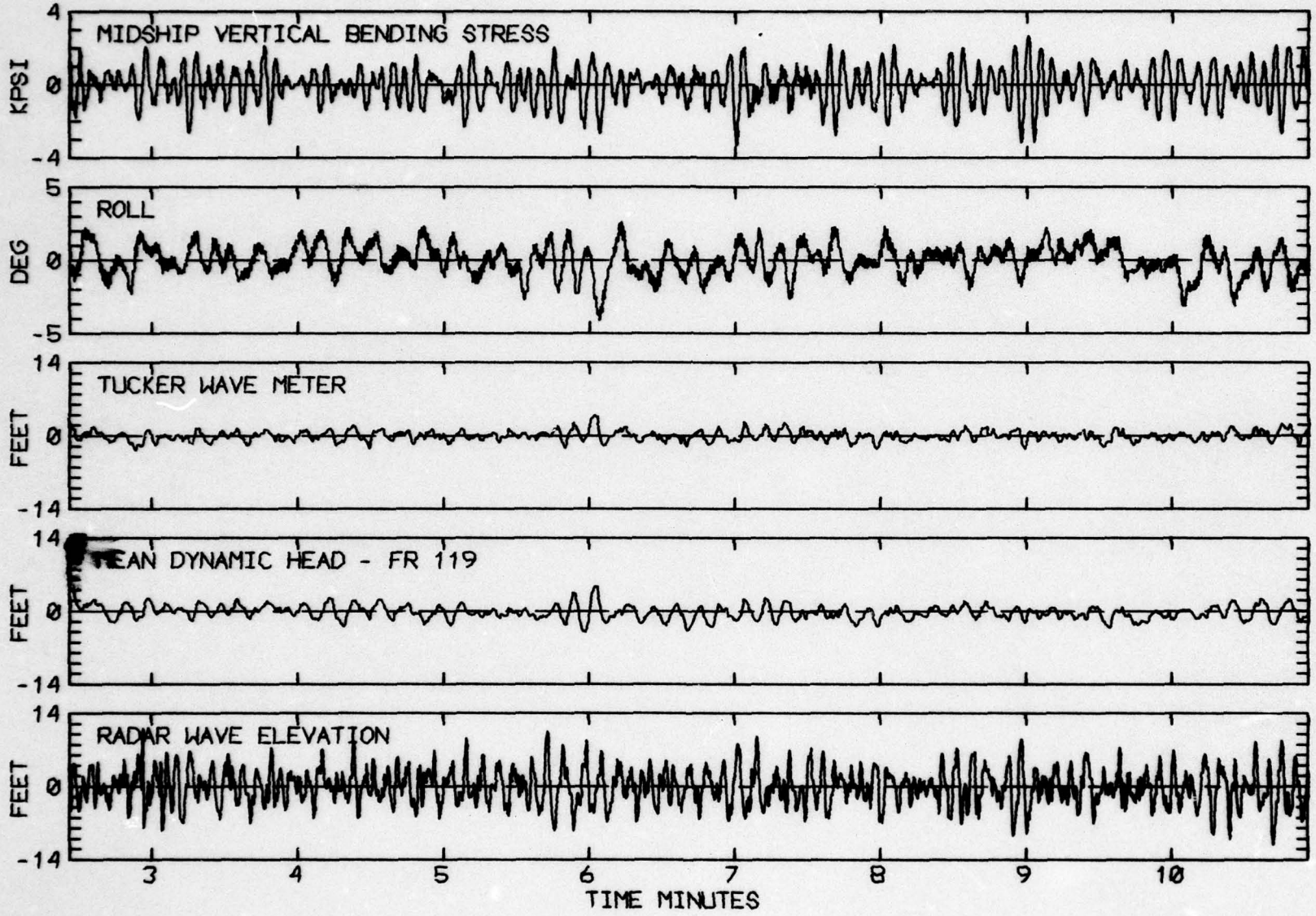
ROLL	4.4 DEG
PITCH	1.20 DEG
DK HSE VERT ACCEL	0.27 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	23.8 FEET
VERTICAL RANGE	22.5 FEET
DISPL AT RADAR	12.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	226	133	288
MAXIMUM HEIGHT	5.7	8.4	24.1
10TH HIGHEST HTS	4.2	6.5	16.6
3RD HIGHEST HTS	3.1	5.2	13.1
4.0 RMS(SPECTRA)	3.9	5.8	14.4



RUN 905 -- VOYAGE 33W -- TAPE 155 -- INDEX 18 -- INTERVAL 5



RUN 905 -- VOYAGE 33W -- TAPE 155 -- INDEX 18 -- INTERVAL 5

LOG BOOK DATA

DATE AND TIME	01-26-74 0800
POSITION	42-51 N 28-27 W
COURSE AND SPEED	266 . 32.6 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	26 STBD
SWELL HEIGHT	8 FEET
" REL DIR	26 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

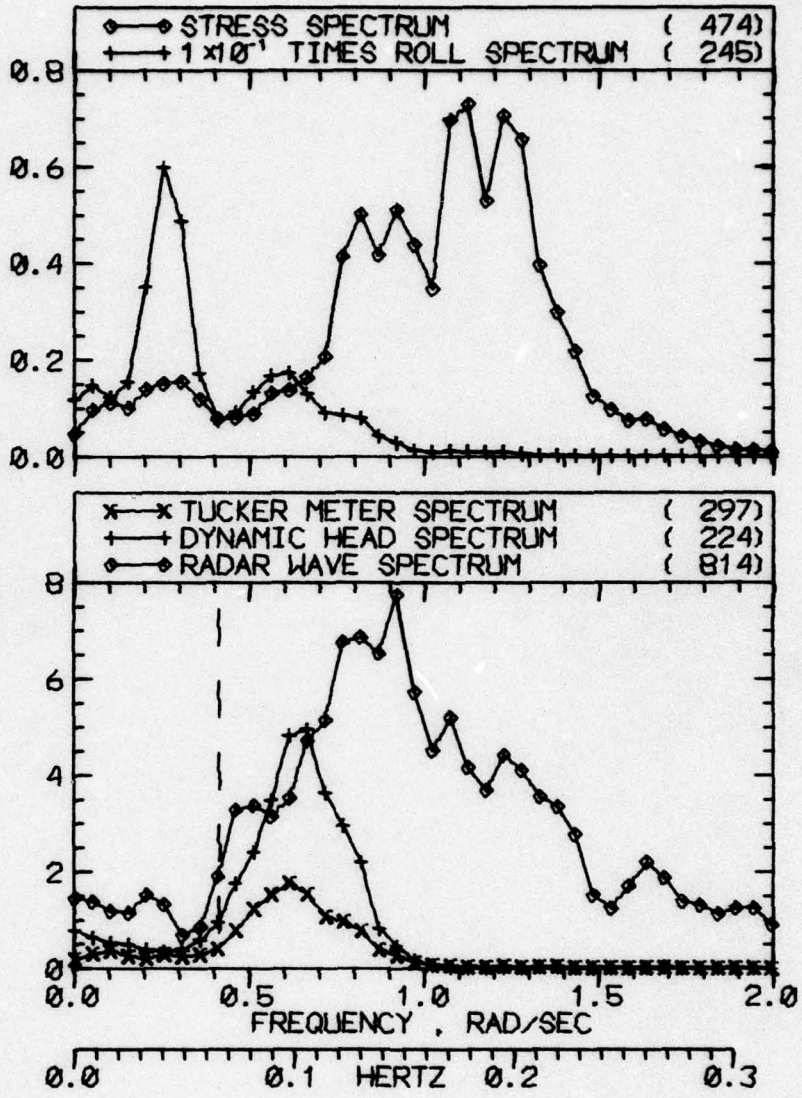
MAXIMUM PK-TR	4.2 KPSI
4.0 X RMS	2.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

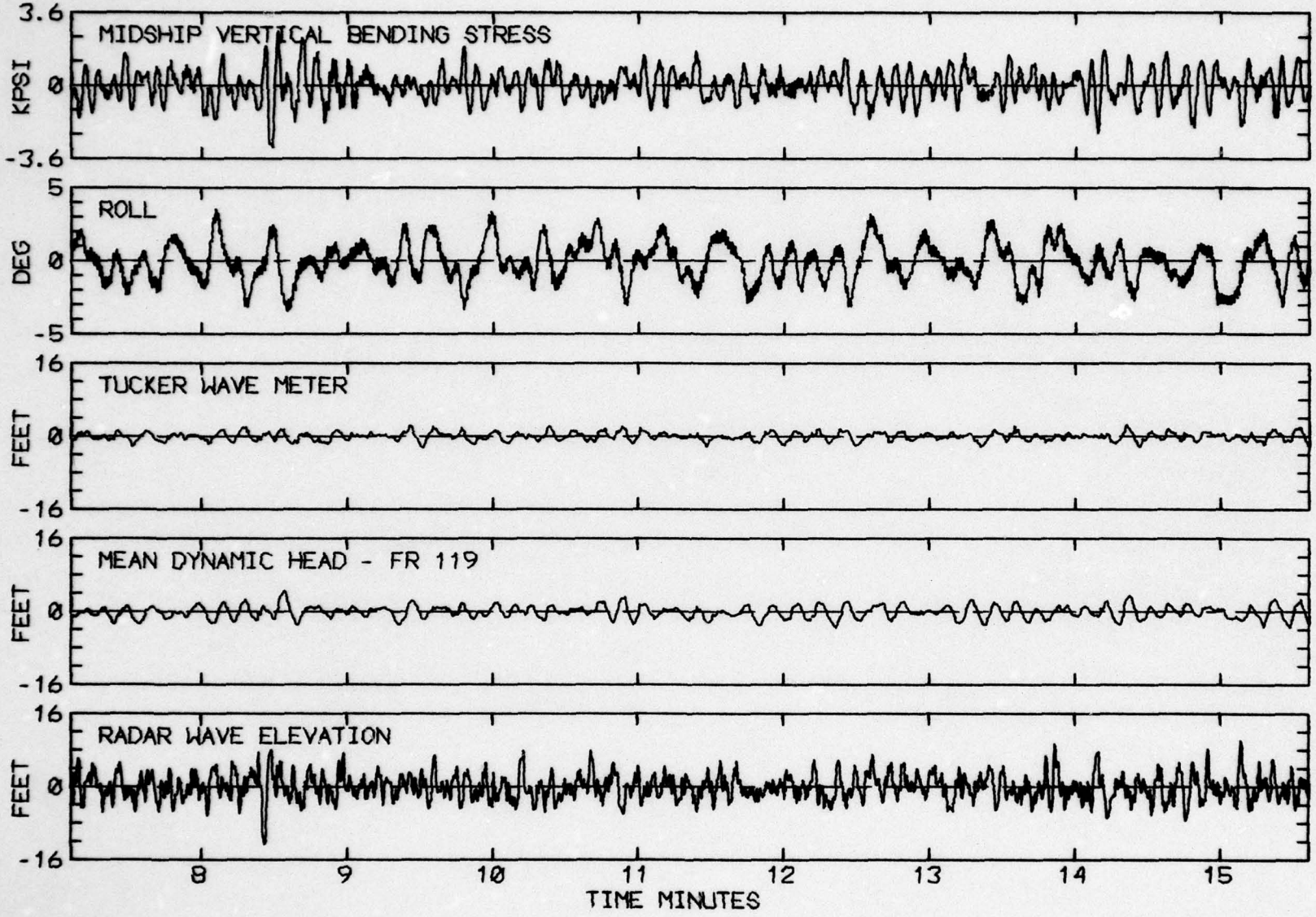
ROLL	5.3 DEG
PITCH	0.85 DEG
DK HSE VERT ACCEL	0.19 G
DK HSE LAT ACCEL	0.13 G
RADAR SLANT RANGE	19.2 FEET
VERTICAL RANGE	16.2 FEET
DISPL AT RADAR	9.9 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	197	125	335
MAXIMUM HEIGHT	5.7	7.3	14.8
10TH HIGHEST HTS	3.7	5.9	11.6
3RD HIGHEST HTS	2.8	4.8	9.2
4.0 RMS(SPECTRA)	3.4	5.2	10.9



RUN 909 -- VOYAGE 33W -- TAPE 155 -- INDEX 19 -- INTERVAL 9



RUN 909 -- VOYAGE 33W -- TAPE 155 -- INDEX 19 -- INTERVAL 9

LOG BOOK DATA

DATE AND TIME	01-26-74 1200
POSITION	41-50 N 45-25 W
COURSE AND SPEED	266 . 32.4 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	4 STBD
SWELL HEIGHT	8 FEET
" REL DIR	4 STBD

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

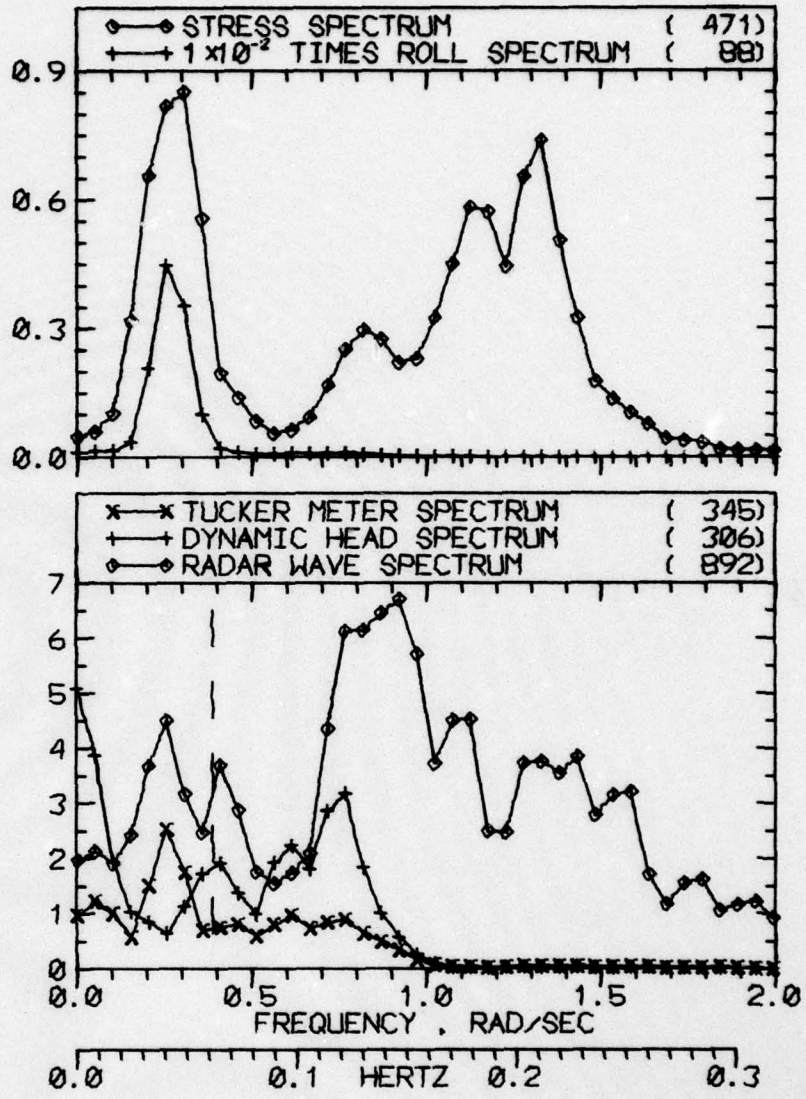
MAXIMUM PK-TR	3.5 KPSI
4.0 X RMS	3.0 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

ROLL	10.3 DEG
PITCH	0.88 DEG
DK HSE VERT ACCEL	0.19 G
DK HSE LAT ACCEL	0.23 G
RADAR SLANT RANGE	22.9 FEET
VERTICAL RANGE	16.0 FEET
DISPL AT RADAR	9.6 FEET

WAVE HEIGHT STATISTICS (FEET)

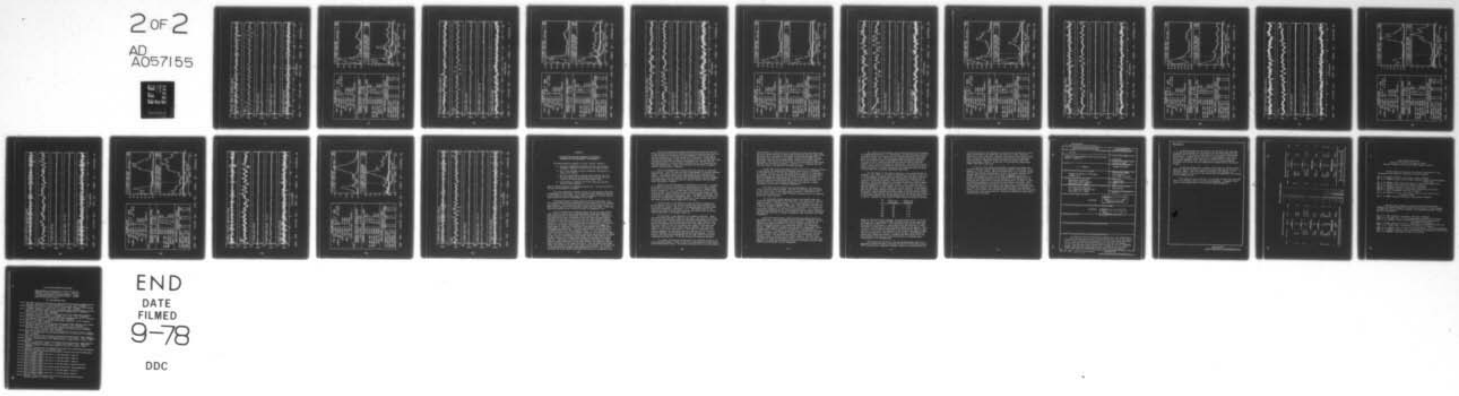
	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	176	145	311
MAXIMUM HEIGHT	6.1	6.6	18.9
10TH HIGHEST HTS	4.1	5.2	11.6
3RD HIGHEST HTS	2.9	4.2	9.3
4.0 RMS(SPECTRA)	4.0	5.3	11.0



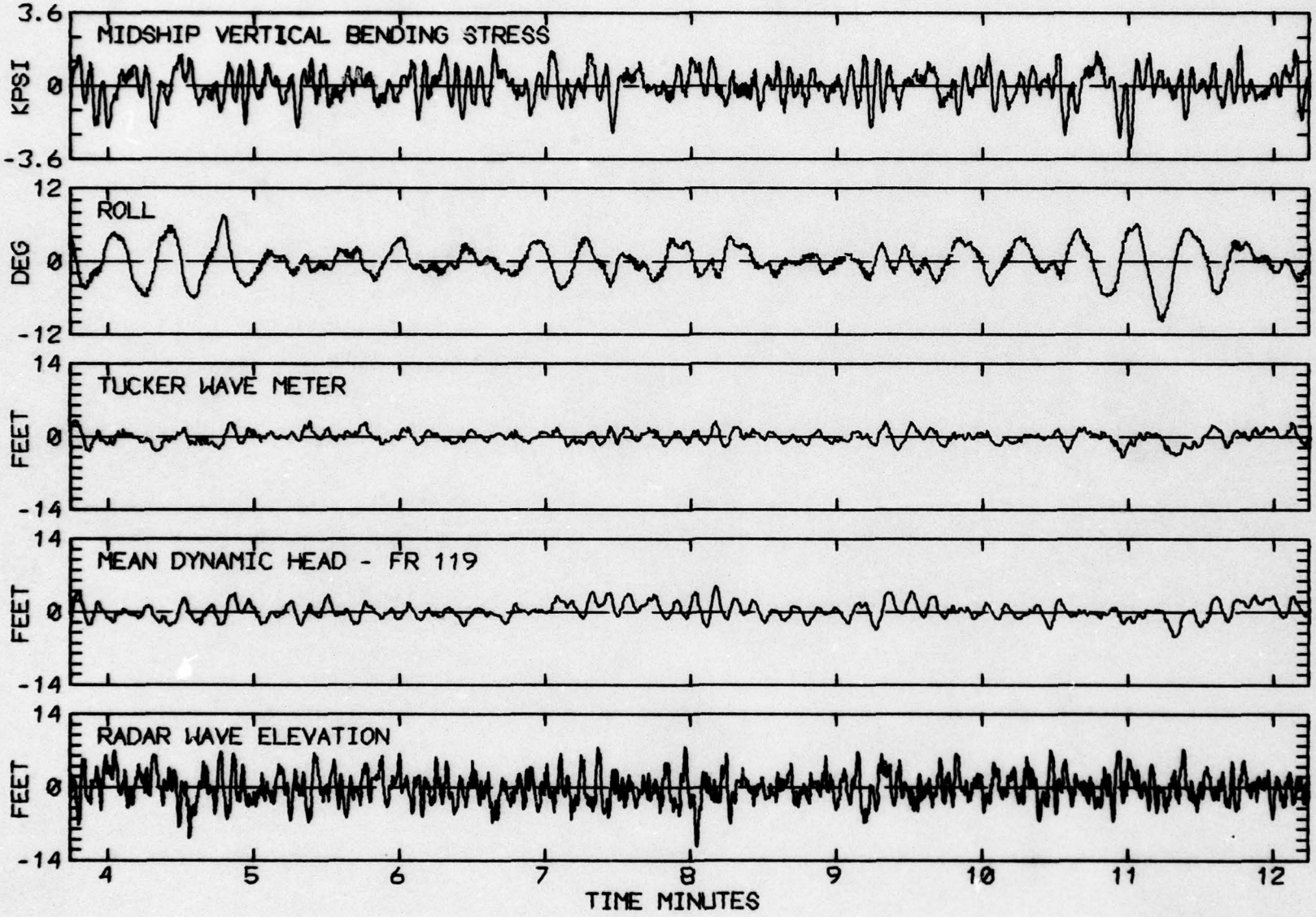
RUN 913 -- VOYAGE 33W -- TAPE 155 -- INDEX 20 -- INTERVAL 13

AD-A057 155 STEVENS INST OF TECH HOBOKEN N J DAVIDSON LAB F/G 8/3
RADAR AND TUCKER WAVEMETER DATA FROM SEA-LAND MCLEAN VOYAGE 33.(U)
AUG 78 J F DALZELL N00024-74-C-5451
UNCLASSIFIED SIT-DL-77-1933 SSC-SL-7-17 NL

2 OF 2
AD A057155



END
DATE FILMED
9-78
DDC



RUN 913 -- VOYAGE 33W -- TAPE 155 -- INDEX 20 -- INTERVAL 13

LOG BOOK DATA

DATE AND TIME	01-26-74 1600
POSITION	41-50 N 45-25 W
COURSE AND SPEED	266 . 32.3 KNOTS
SEA STATE	6
WAVE HEIGHT	2 FEET
" REL DIR	49 STBD
SWELL HEIGHT	8 FEET
" REL DIR	49 STBD

---- VISUAL WEATHER / COMMENTS ----

PT CLDY /

MIDSHIP VERTICAL BENDING STRESS

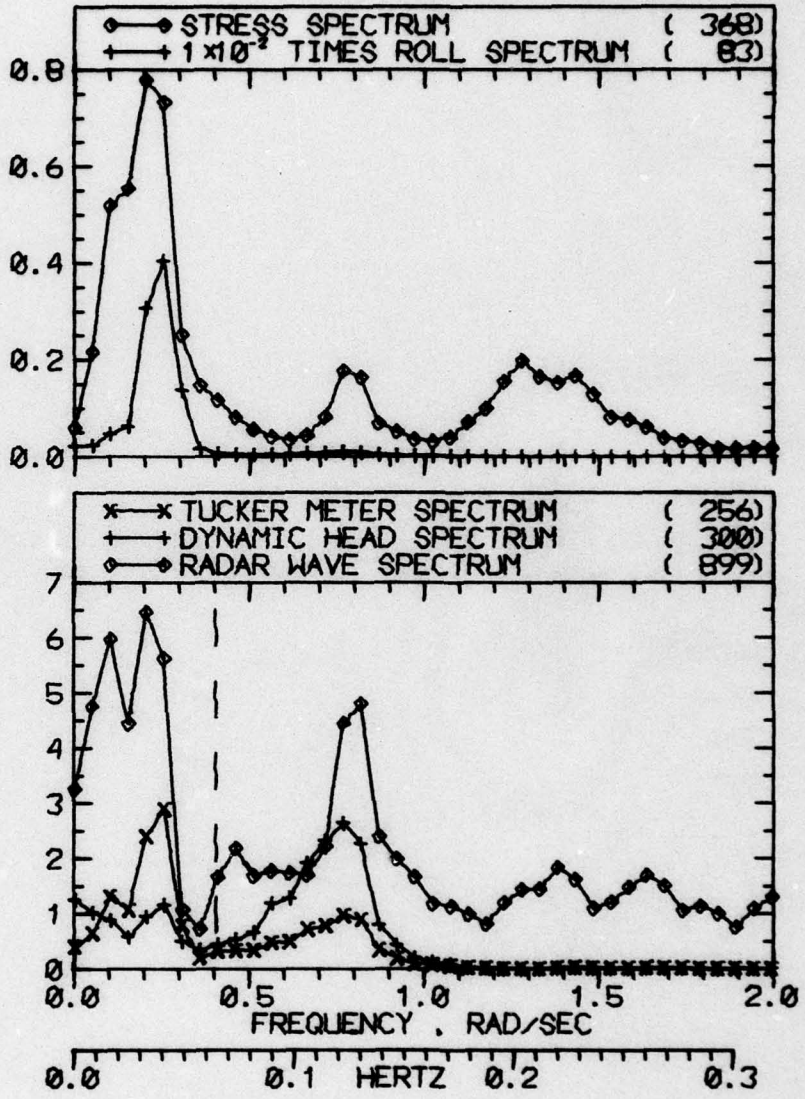
MAXIMUM PK-TR	3.3 KPSI
4.0 X RMS	2.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

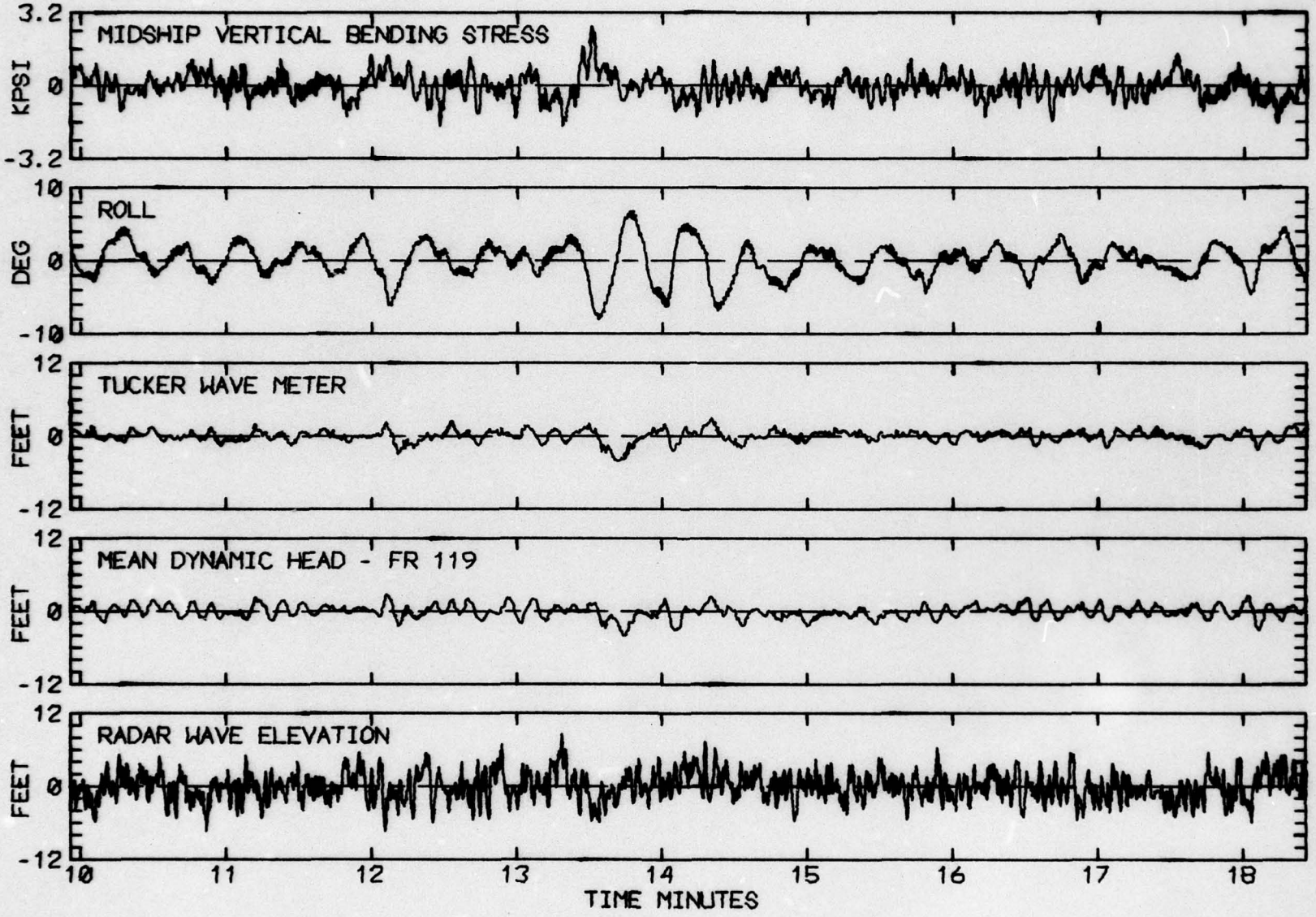
ROLL	9.5 DEG
PITCH	0.62 DEG
DK HSE VERT ACCEL	0.13 G
DK HSE LAT ACCEL	0.20 G
RADAR SLANT RANGE	20.1 FEET
VERTICAL RANGE	12.7 FEET
DISPL AT RADAR	6.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	177	163	374
MAXIMUM HEIGHT	6.5	5.8	12.6
10TH HIGHEST HTS	3.9	4.7	9.8
3RD HIGHEST HTS	2.6	3.6	7.6
4.0 RMS(SPECTRA)	3.7	4.2	9.6



RUN 917 -- VOYAGE 33W -- TAPE 155 -- INDEX 21 -- INTERVAL 17



RUN 917 -- VOYAGE 33W -- TAPE 155 -- INDEX 21 -- INTERVAL 17

LOG BOOK DATA

DATE AND TIME	01-26-74 2000
POSITION	41-50 N 45-25 W
COURSE AND SPEED	267 . 33.1 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	48 STBD
SWELL HEIGHT	6 FEET
" REL DIR	48 STBD

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

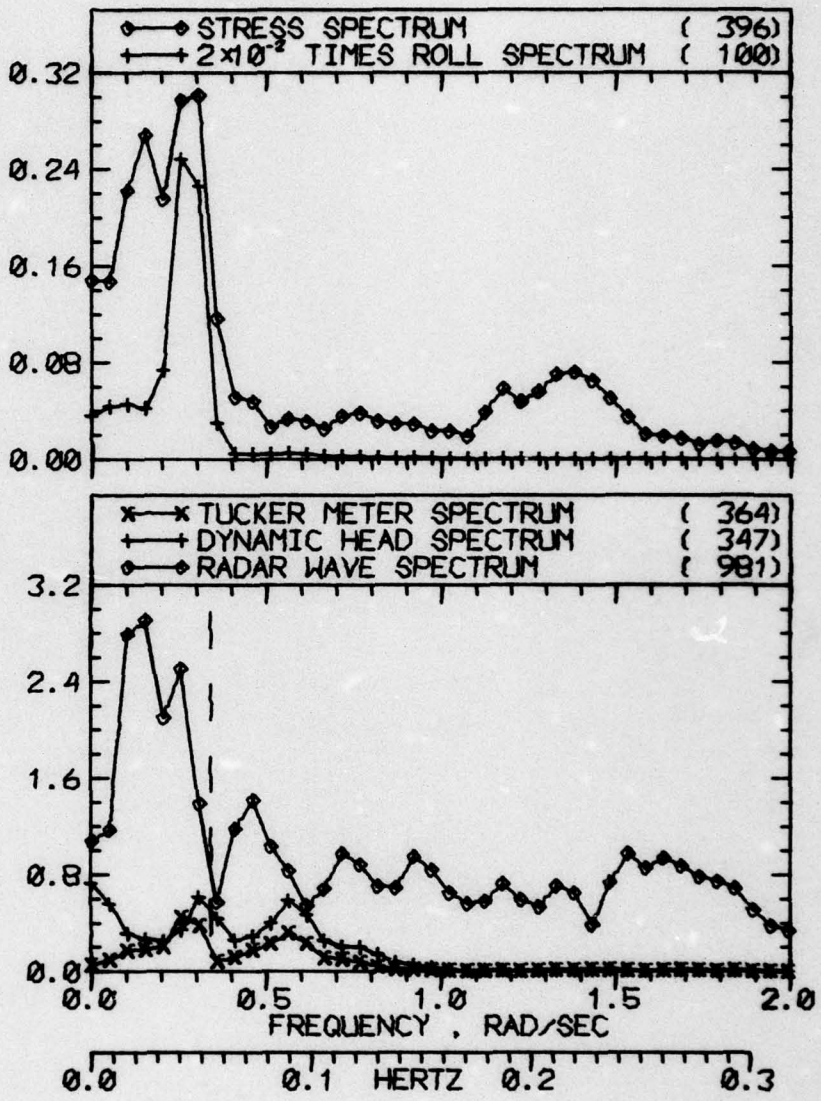
MAXIMUM PK-TR	2.0 KPSI
4.0 X RMS	1.6 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

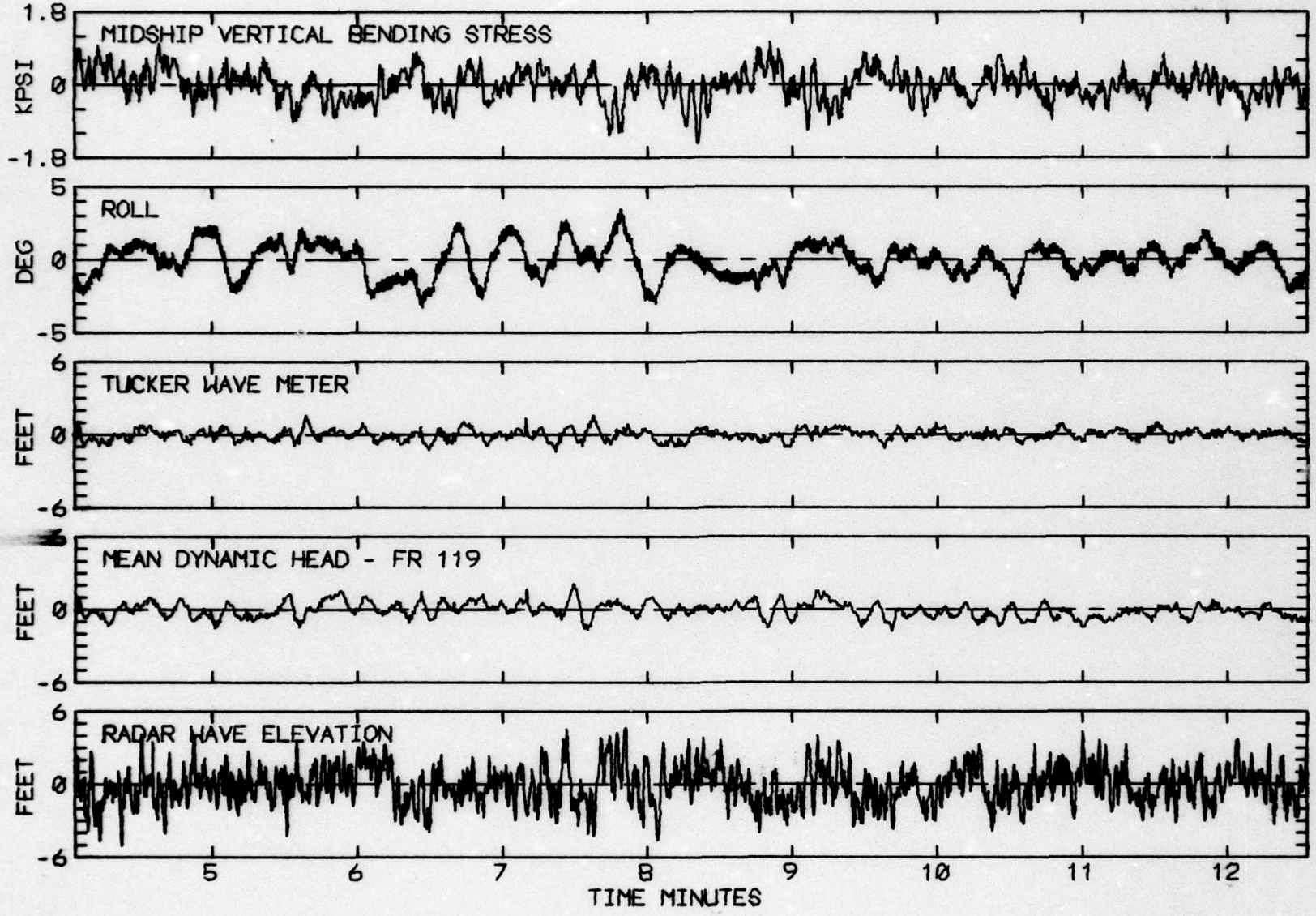
ROLL	5.7 DEG
PITCH	0.60 DEG
DK HSE VERT ACCEL	0.06 G
DK HSE LAT ACCEL	0.13 G
RADAR SLANT RANGE	11.7 FEET
VERTICAL RANGE	7.4 FEET
DISPL AT RADAR	3.6 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	392	203	379
MAXIMUM HEIGHT	2.6	3.1	7.9
10TH HIGHEST HTS	1.4	2.3	6.2
3RD HIGHEST HTS	1.0	1.6	4.9
4.0 RMS(SPECTRA)	1.8	2.3	6.5



RUN 921 -- VOYAGE 33W -- TAPE 155 -- INDEX 22 -- INTERVAL 21



RUN 921 -- VOYAGE 33W -- TAPE 155 -- INDEX 22 -- INTERVAL 21

LOG BOOK DATA

DATE AND TIME	01-26-74 2400
POSITION	41-50 N 45-25 W
COURSE AND SPEED	267 . 32.4 KNOTS
SEA STATE	4
WAVE HEIGHT	2 FEET
" REL DIR	48 STBD
SWELL HEIGHT	6 FEET
" REL DIR	48 STBD

---- VISUAL WEATHER / COMMENTS ----

CLEAR /

MIDSHIP VERTICAL BENDING STRESS

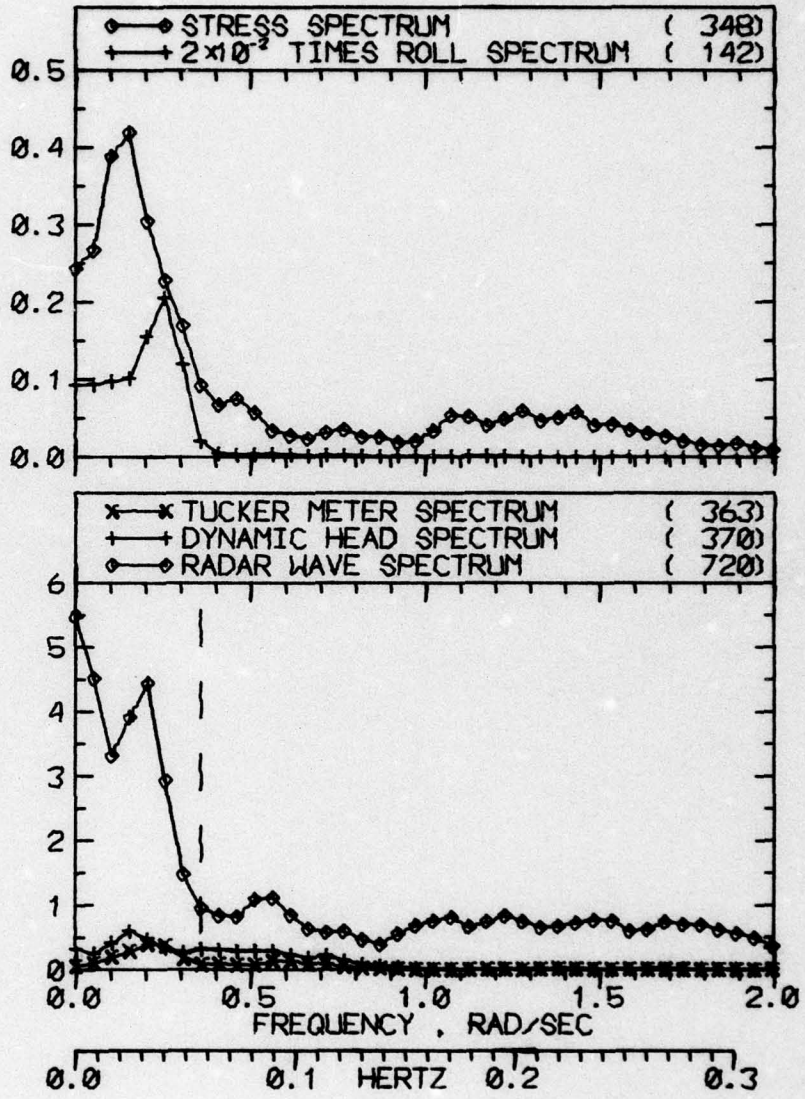
MAXIMUM PK-TR	2.0 KPSI
4.0 X RMS	1.7 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

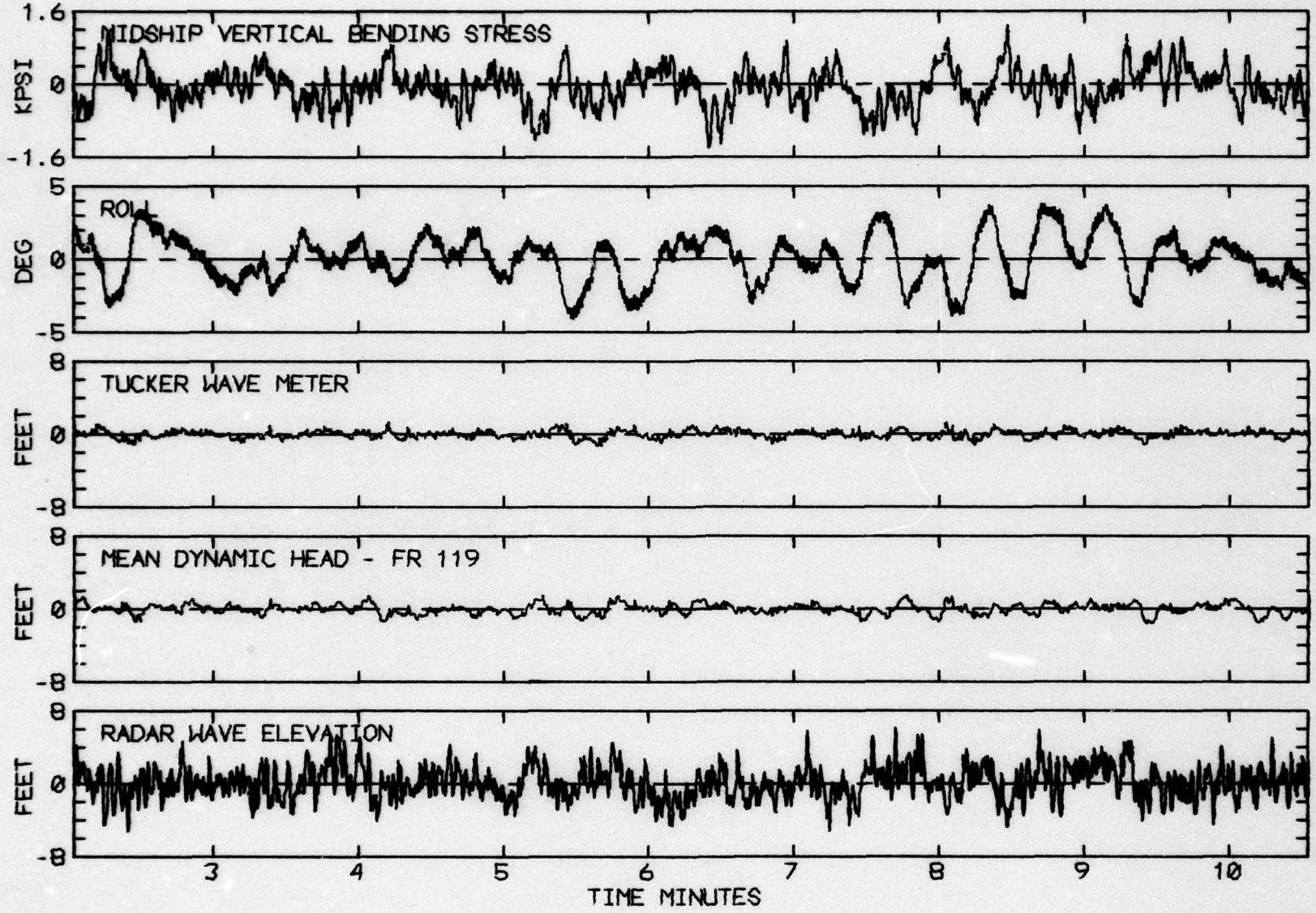
ROLL	6.1 DEG
PITCH	0.59 DEG
DK HSE VERT ACCEL	0.06 G
DK HSE LAT ACCEL	0.13 G
RADAR SLANT RANGE	12.6 FEET
VERTICAL RANGE	7.9 FEET
DISPL AT RADAR	3.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	386	245	366
MAXIMUM HEIGHT	2.1	2.6	7.5
10TH HIGHEST HTS	1.3	1.8	6.6
3RD HIGHEST HTS	1.0	1.3	5.4
4.0 RMS(SPECTRA)	1.6	2.1	7.3



RUN 925 -- VOYAGE 33W -- TAPE 155 -- INDEX 23 -- INTERVAL 25



RUN 925 -- VOYAGE 33W -- TAPE 155 -- INDEX 23 -- INTERVAL 25

LOG BOOK DATA

DATE AND TIME	01-27-74 0400
POSITION	41-50 N 45-25 W
COURSE AND SPEED	267 . 32.4 KNOTS
SEA STATE	3
WAVE HEIGHT	1 FEET
" REL DIR	48 STBD
SWELL HEIGHT	6 FEET
" REL DIR	48 STBD

---- VISUAL WEATHER / COMMENTS ----

CLEAR /

MIDSHIP VERTICAL BENDING STRESS

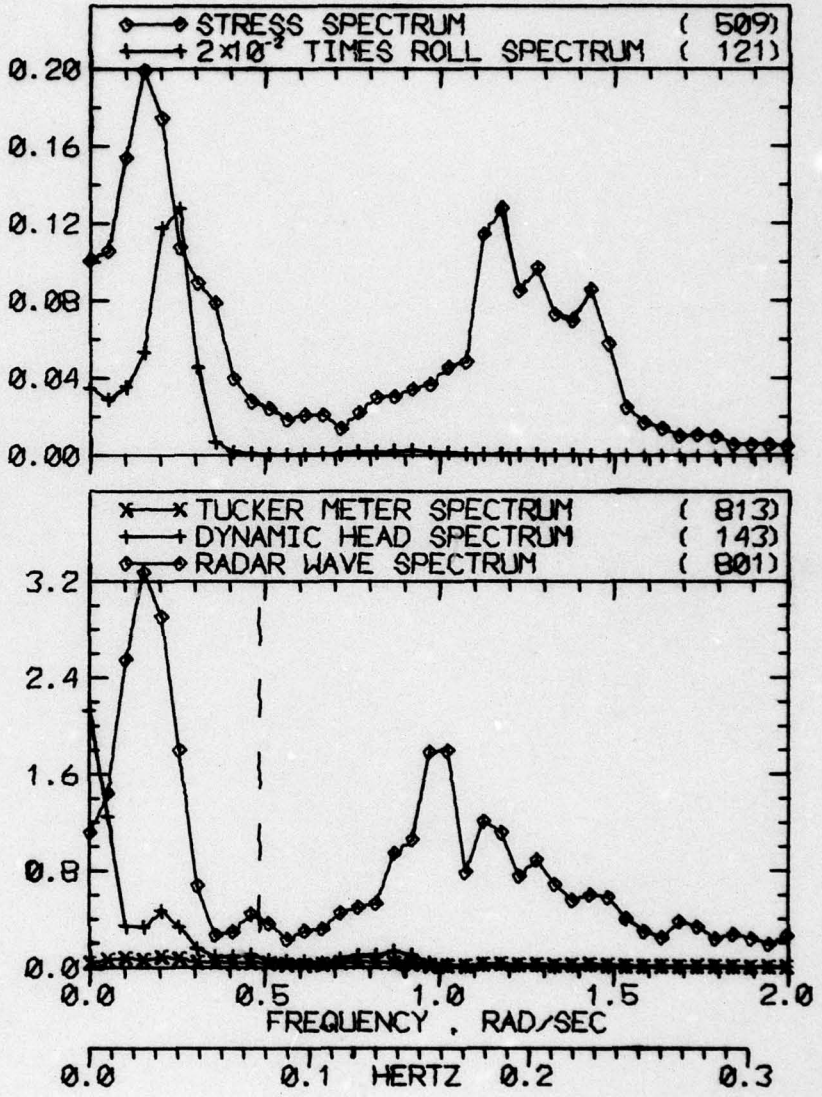
MAXIMUM PK-TR	1.5 KPSI
4.0 X RMS	1.4 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

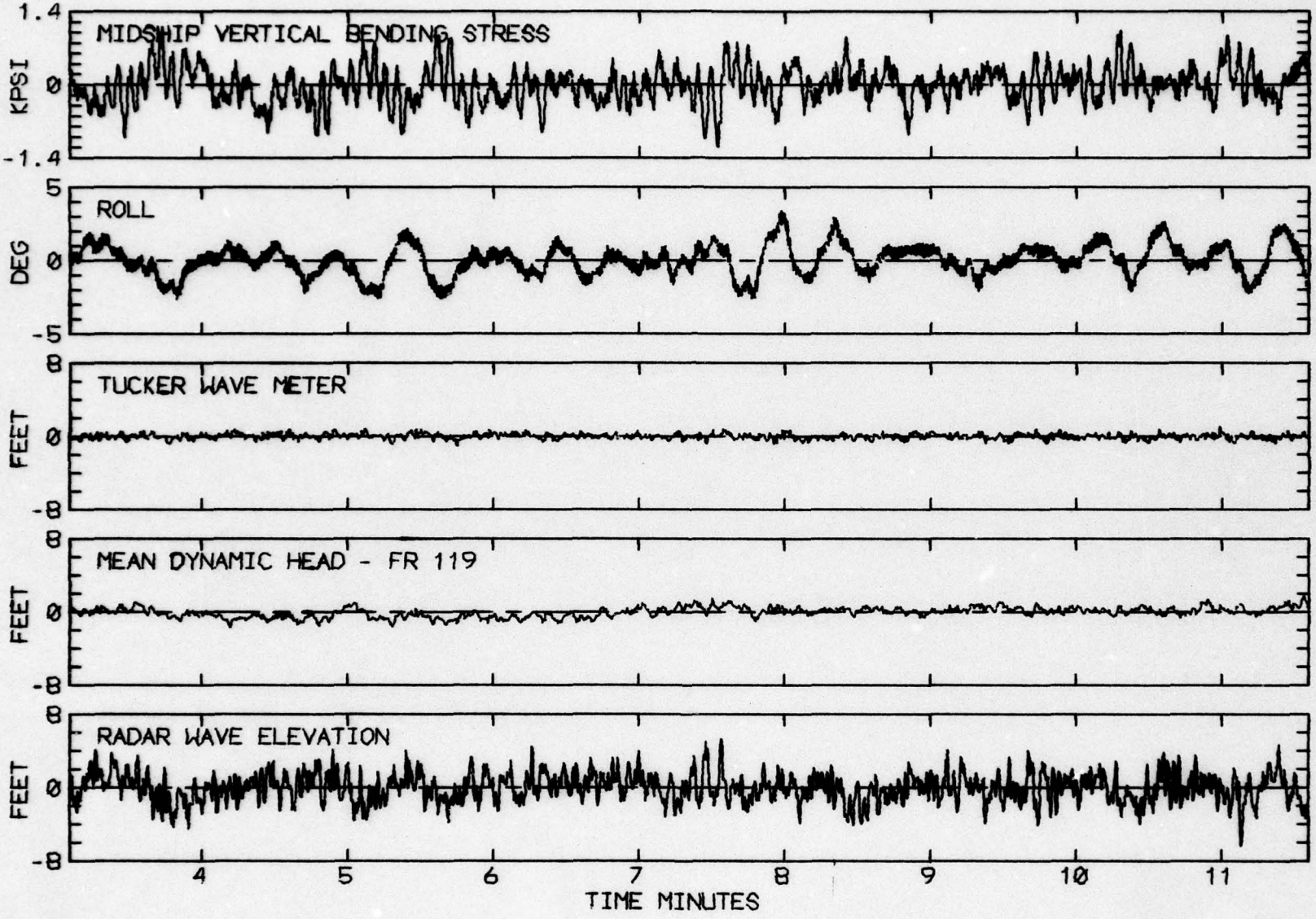
ROLL	4.4 DEG
PITCH	0.67 DEG
DK HSE VERT ACCEL	0.08 G
DK HSE LAT ACCEL	0.10 G
RADAR SLANT RANGE	9.9 FEET
VERTICAL RANGE	7.1 FEET
DISPL AT RADAR	3.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	610	222	378
MAXIMUM HEIGHT	1.3	2.7	8.3
10TH HIGHEST HTS	1.0	1.6	6.1
3RD HIGHEST HTS	0.8	1.2	4.9
4.0 RMS(SPECTRA)	1.2	2.1	6.1



RUN 929 -- VOYAGE 33W -- TAPE 155 -- INDEX 24 -- INTERVAL 29



RUN 929 -- VOYAGE 33W -- TAPE 155 -- INDEX 24 -- INTERVAL 29

LOG BOOK DATA

DATE AND TIME	01-27-74 1200
POSITION	40-45 N 62-42 W
COURSE AND SPEED	266 . 32.2 KNOTS
SEA STATE	8
WAVE HEIGHT	6 FEET
" REL DIR	41 PORT
SWELL HEIGHT	8 FEET
" REL DIR	41 PORT

---- VISUAL WEATHER / COMMENTS ----

RAIN SQUALLS /

MIDSHIP VERTICAL BENDING STRESS

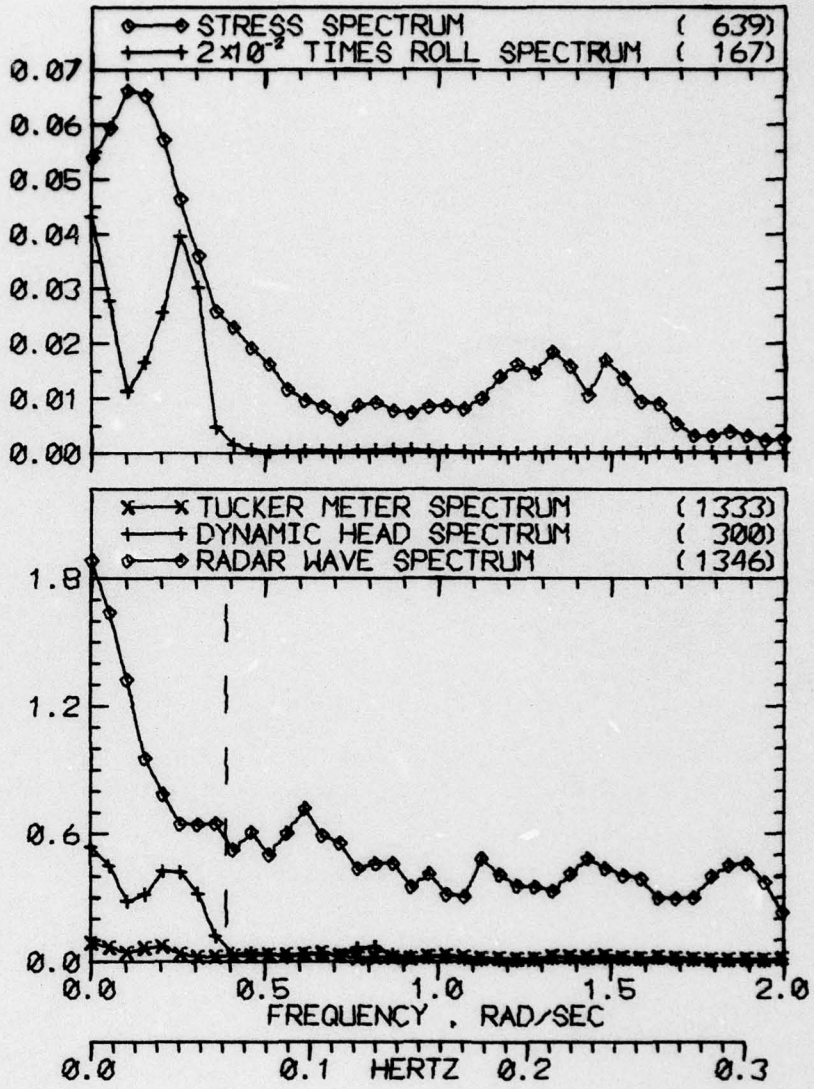
MAXIMUM PK-TR	0.9 KPSI
4.0 X RMS	0.9 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

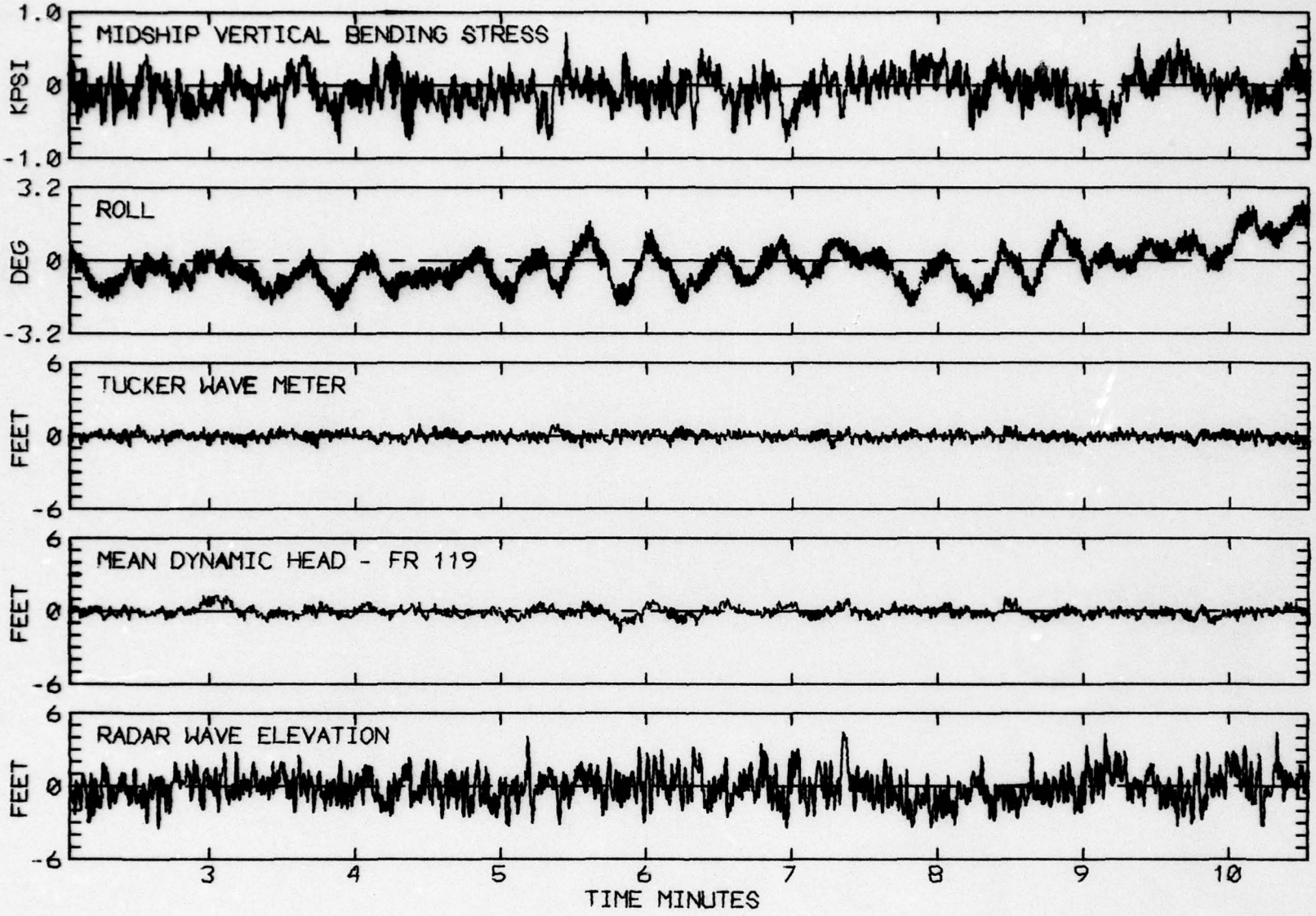
ROLL	3.0 DEG
PITCH	0.58 DEG
DK HSE VERT ACCEL	0.04 G
DK HSE LAT ACCEL	0.08 G
RADAR SLANT RANGE	6.8 FEET
VERTICAL RANGE	5.5 FEET
DISPL AT RADAR	1.5 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	670	427	448
MAXIMUM HEIGHT	1.5	2.1	7.1
10TH HIGHEST HTS	1.2	1.2	4.9
3RD HIGHEST HTS	0.9	0.9	4.0
4.0 RMS(SPECTRA)	1.3	1.8	5.3



RUN 937 -- VOYAGE 33W -- TAPE 155 -- INDEX 26 -- INTERVAL 37



RUN 937 -- VOYAGE 33W -- TAPE 155 -- INDEX 26 -- INTERVAL 37

LOG BOOK DATA

DATE AND TIME	01-27-74 1600
POSITION	40-45 N 62-42 W
COURSE AND SPEED	265 . 31.8 KNOTS
SEA STATE	9
WAVE HEIGHT	8 FEET
" REL DIR	40 PORT
SWELL HEIGHT	8 FEET
" REL DIR	40 PORT

---- VISUAL WEATHER / COMMENTS ----

OCAST /

MIDSHIP VERTICAL BENDING STRESS

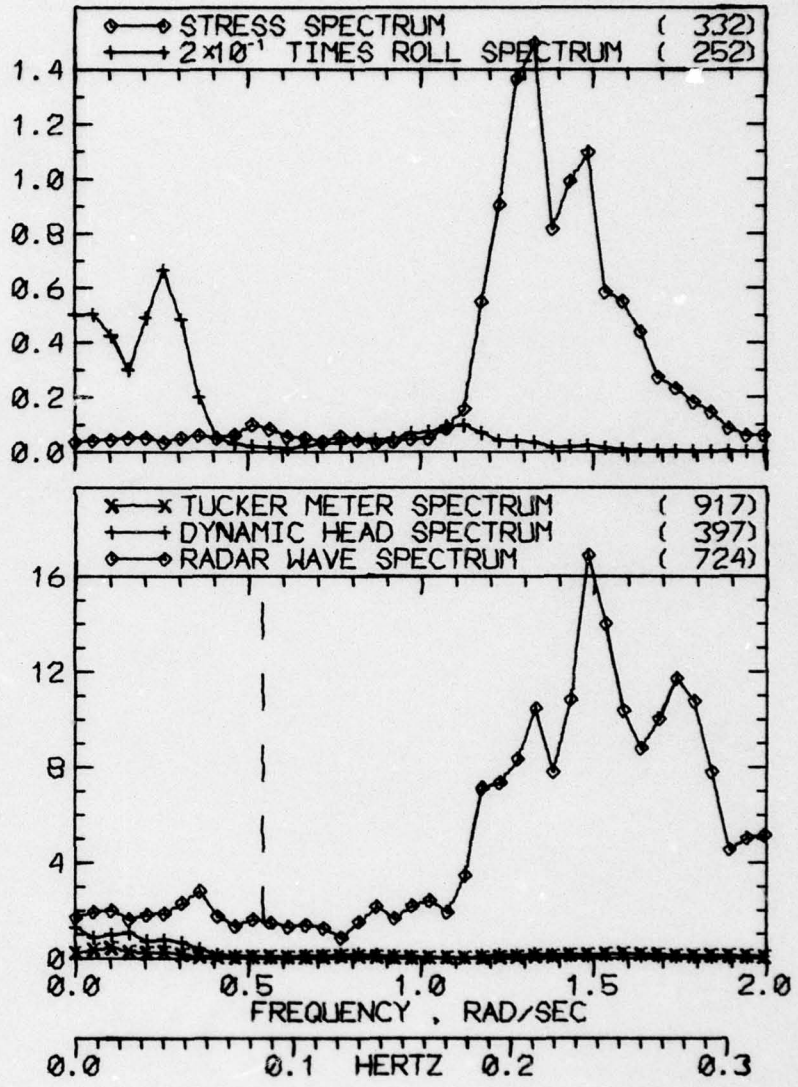
MAXIMUM PK-TR	4.4 KPSI
4.0 X RMS	3.2 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

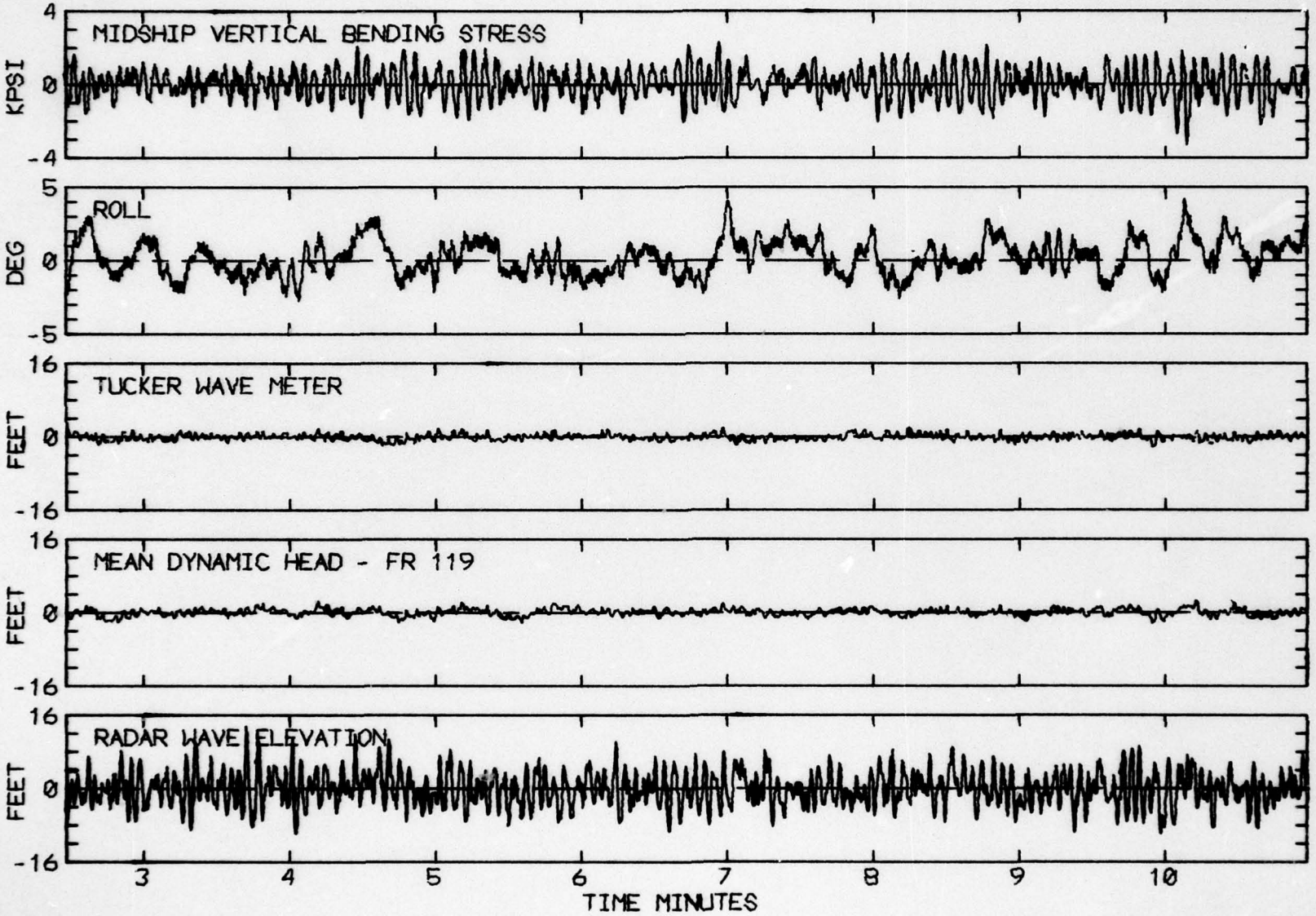
ROLL	4.3 DEG
PITCH	0.82 DEG
DK HSE VERT ACCEL	0.14 G
DK HSE LAT ACCEL	0.11 G
RADAR SLANT RANGE	16.5 FEET
VERTICAL RANGE	15.6 FEET
DISPL AT RADAR	4.1 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN.	HEAD/RADAR	
P-T SAMPLE SIZE	471	300	323
MAXIMUM HEIGHT	3.2	4.0	22.0
10TH HIGHEST HTS	2.3	2.6	16.7
3RD HIGHEST HTS	1.9	2.0	13.7
4.0 RMS(SPECTRA)	2.4	3.0	14.4



RUN 941 -- VOYAGE 33W -- TAPE 155 -- INDEX 27 -- INTERVAL 41



RUN 941 -- VOYAGE 33W -- TAPE 155 -- INDEX 27 -- INTERVAL 41

LOG BOOK DATA

DATE AND TIME	01-27-74 2000
POSITION	40-45 N 62-42 W
COURSE AND SPEED	266 . 32.1 KNOTS
SEA STATE	8
WAVE HEIGHT	5 FEET
" REL DIR	41 PORT
SWELL HEIGHT	5 FEET
" REL DIR	41 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

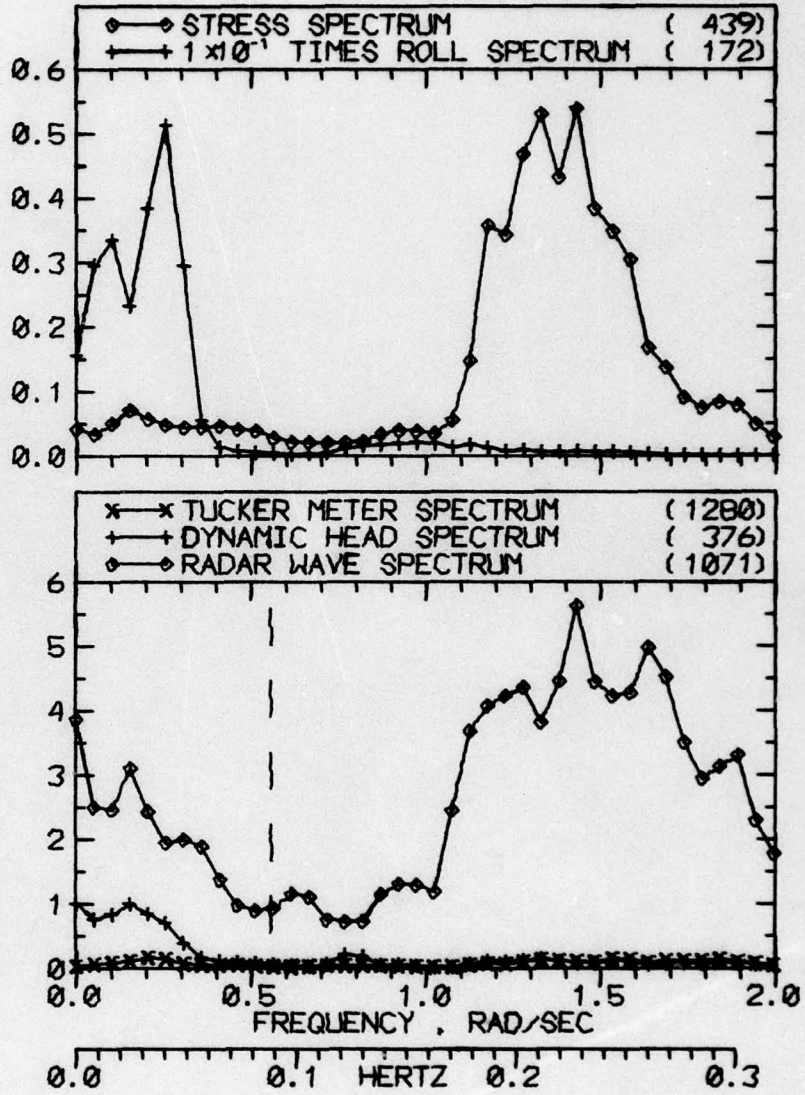
MAXIMUM PK-TR	2.8 KPSI
4.0 X RMS	2.3 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

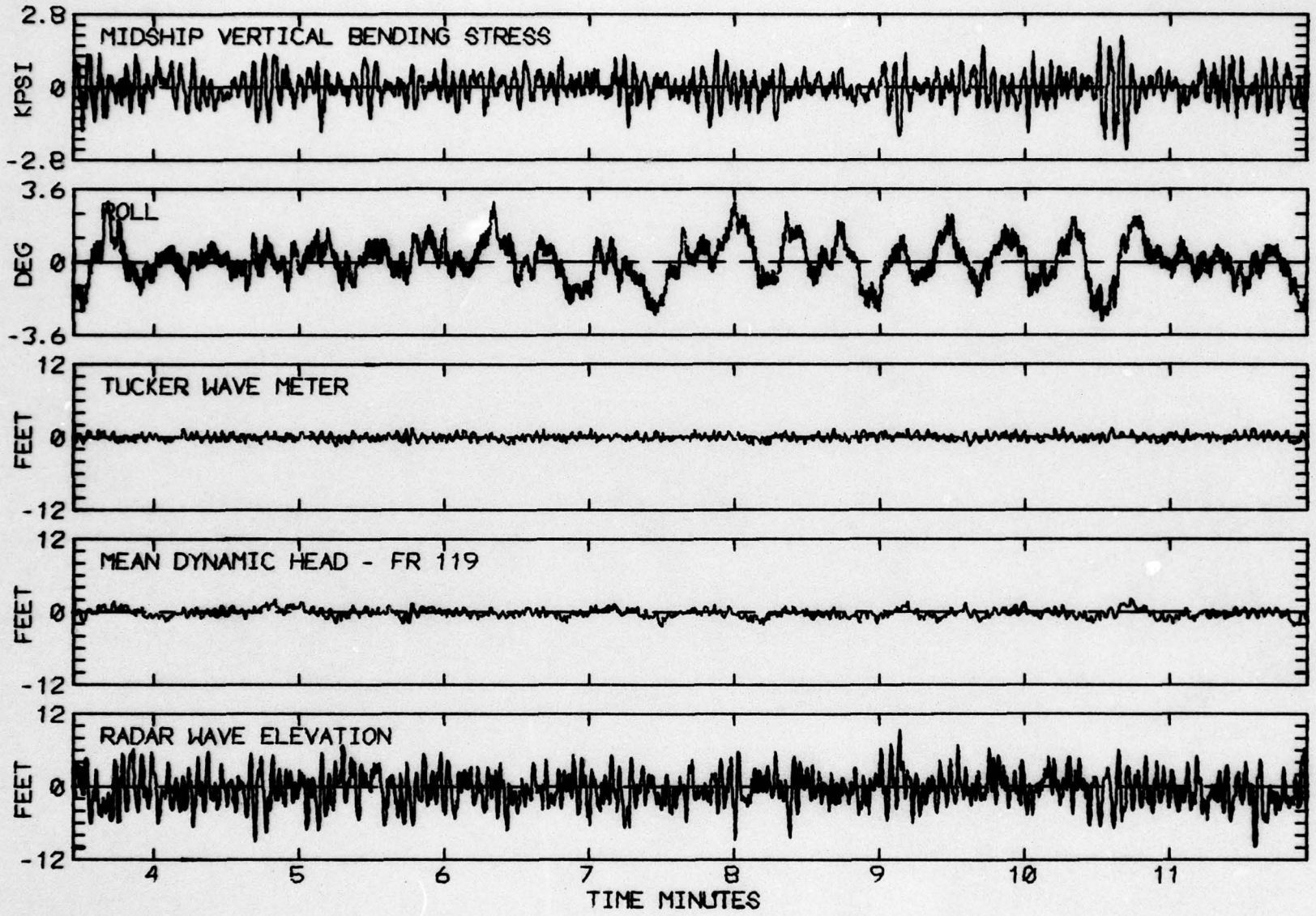
ROLL	4.6 DEG
PITCH	0.75 DEG
DK HSE VERT ACCEL	0.11 G
DK HSE LAT ACCEL	0.12 G
RADAR SLANT RANGE	13.4 FEET
VERTICAL RANGE	11.6 FEET
DISPL AT RADAR	3.0 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	488	307	356
MAXIMUM HEIGHT	2.7	2.8	15.1
10TH HIGHEST HTS	2.0	2.2	11.4
3RD HIGHEST HTS	1.7	1.8	9.5
4.0 RMS(SPECTRA)	2.0	2.7	10.8



RUN 945 -- VOYAGE 33W -- TAPE 155 -- INDEX 28 -- INTERVAL 45



RUN 945 -- VOYAGE 33W -- TAPE 155 -- INDEX 28 -- INTERVAL 45

LOG BOOK DATA

DATE AND TIME	01-27-74 2400
POSITION	40-45 N 62-42 W
COURSE AND SPEED	268 , 32.3 KNOTS
SEA STATE	6
WAVE HEIGHT	5 FEET
" REL DIR	43 PORT
SWELL HEIGHT	5 FEET
" REL DIR	43 PORT

---- VISUAL WEATHER / COMMENTS ----

CLDY /

MIDSHIP VERTICAL BENDING STRESS

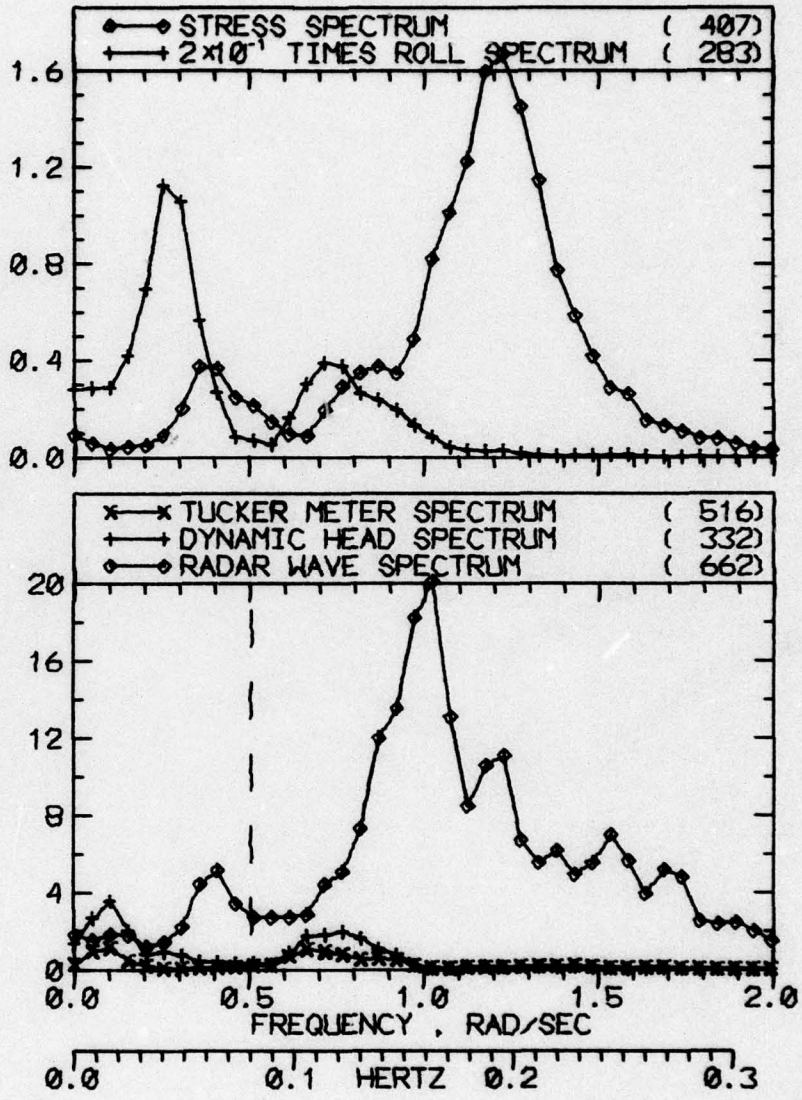
MAXIMUM PK-TR	4.7 KPSI
4.0 X RMS	3.8 KPSI

SUMMARY OF MOTIONS (4.0 X RMS)

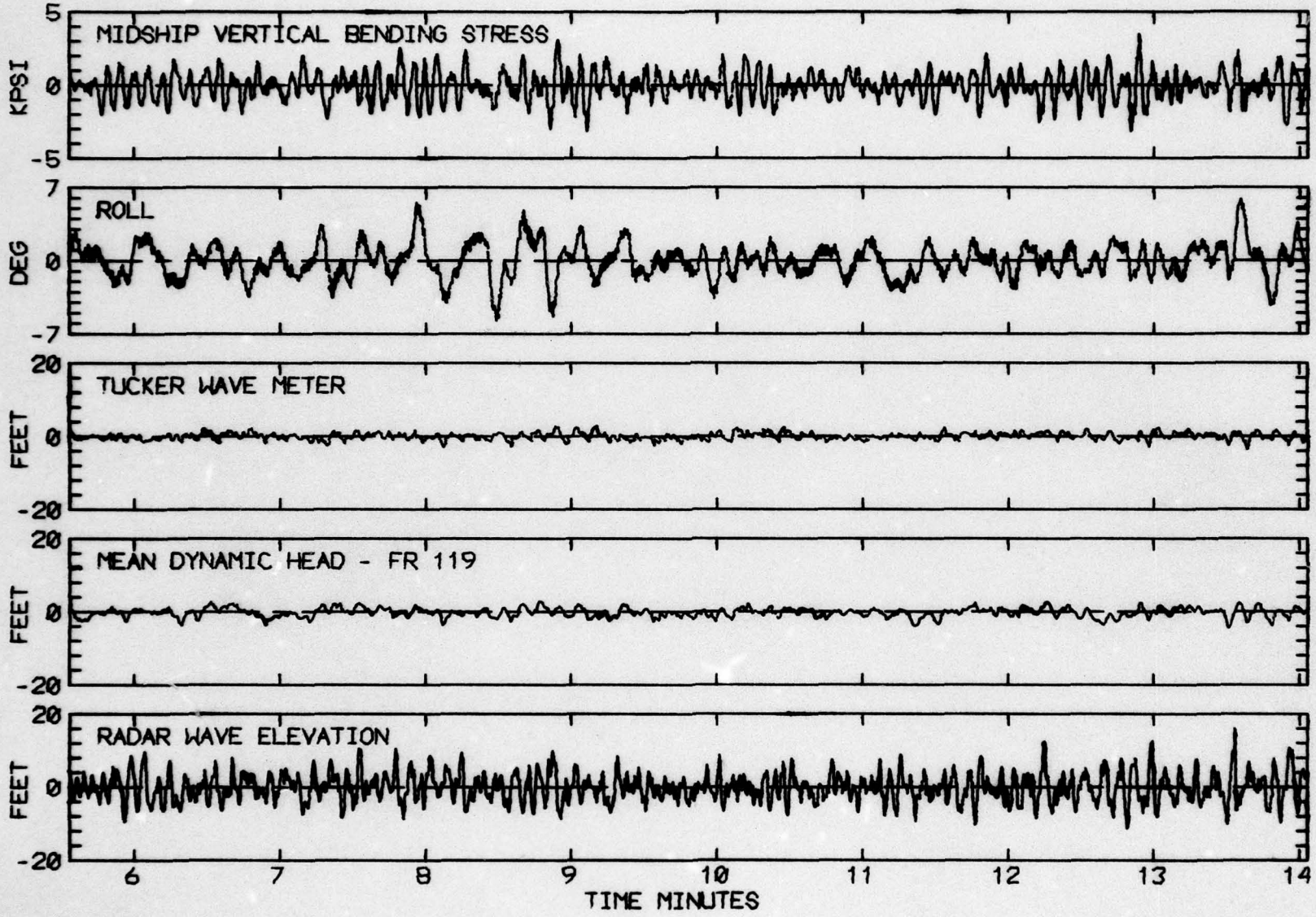
ROLL	5.6 DEG
PITCH	1.27 DEG
DK HSE VERT ACCEL	0.28 G
DK HSE LAT ACCEL	0.15 G
RADAR SLANT RANGE	19.3 FEET
VERTICAL RANGE	18.7 FEET
DISPL AT RADAR	10.4 FEET

WAVE HEIGHT STATISTICS (FEET)

	TUCKER/DYN. HEAD/RADAR		
P-T SAMPLE SIZE	297	206	292
MAXIMUM HEIGHT	4.9	5.4	23.5
10TH HIGHEST HTS	3.4	4.4	17.1
3RD HIGHEST HTS	2.6	3.3	13.3
4.0 RMS(SPECTRA)	3.4	4.7	14.7



RUN 949 -- VOYAGE 33W -- TAPE 155 -- INDEX 29 -- INTERVAL 49



RUN 949 -- VOYAGE 33W -- TAPE 155 -- INDEX 29 -- INTERVAL 49

APPENDIX

THE DATA REDUCTION AND PRESENTATION PROCEDURE ACCORDING TO THE DEVELOPMENT IN REFERENCE 4

The data reduction procedure for each interval involved:

a. Four main computation programs, the last one of which produced a complete file of results for each interval.

b. Two lister programs to supply immediate indications of some of the results.

c. One file consolidation program which produced one file for each voyage leg containing everything but the time histories of radar wave and mean dynamic head.

d. Two programs to generate the final graphical presentations for each interval.

Items b through d amount to bookkeeping operations. The work was done in the four main computation programs.

The first computation program carried out the procedure described in Reference 4 for the radar. At its conclusion the radar wave spectrum and the computed time history were written in temporary files as was the time history of vertical displacement at the radar.

The second program involved reduction of the Tucker data. Both the original data and the displacement file produced by the first program were accessed. The procedure was carried out so that time histories of mean dynamic head and the Tucker Meter signal were available. These were spectrum analyzed, and all results written in a temporary file.

The third computation program accessed the various wave-related time histories (radar, Tucker, and mean dynamic head) and performed a peak-trough analysis on the middle 16-1/2 minutes of each. (Because of the tapering described in Reference 4 both the radar and mean dynamic head data are not valid for the first and last two minutes of sample.) The object of the peak-trough analysis was to produce double amplitude statistics. The zero crossing convention was used; that is, a crest was defined as the largest instantaneous value in an excursion <u>above</u> the sample mean, a trough was the smallest instantaneous value in an excursion <u>below</u> the sample mean. The double amplitude is the difference in elevation between crest and succeeding trough. In this approach small fluctuations are more or less ignored if they are riding on top of large ones. The results resemble the double amplitudes which would be estimated by hand from an oscillograph record except that the hand analyst would probably visually fair through superimposed noise whereas the computer does not. The effect is that while the computer gets about the same number of double amplitudes as the human analyst, the computer's answers tend to be higher if the records are noisy. From the double amplitudes found, the average of 1/3 and 1/10 highest were computed, and the position in the sample of the largest double amplitude was noted. All results, including the actual double amplitudes were written in a temporary file.

The fourth computation program accessed the original data and performed spectrum analyses upon the midship vertical bending stress and roll. It then accessed all previously written temporary files and produced a new file containing all of the results for the interval. These results included log-book data, results of the first analysis of raw data (Ref.3,5), five spectra along with all analysis parameters, all results from the peak-trough analysis, and the two new time histories, the radar wave and the mean dynamic head. These files were meant to be stored on magnetic tape for possible future reference.

The final presentation of results for each interval is contained on two charts. The first type of chart (which appears on the even numbered pages of this report) contains the scalar spectra and a tabulation of results. The second type of chart (odd numbered pages) involves sample time histories. Both are identified at the bottom with the DL run number, the voyage number, the analog tape and interval numbers, and the index number assigned by Teledyne.

Referring to any even page, the tabulation at the left is intended as a summary of the most significant numbers pertaining to the interval. At the top is as much of the original log-book data as it seemed reasonable to squeeze in. This includes date, time, position, and ship speed, as well as the visual estimates of wave and swell heights and directions. Directions are counted from the bow to port or starboard in degrees. The "sea state" is apparently the Beaufort wind. The final line in the first section of the tabulation includes comments on visual weather and, after the slash, any other comment appearing in the log.

The second box in the tabulation involves midship longitudinal stress results. Only two of the many numbers which are available could be included as indices. The first is the maximum peak to trough stress excursion as obtained in Reference 1 or 2. The second index is the significant stress (4 times rms) as derived from the area of the stress spectrum obtained in the present reduction.

The third box in the tabulation is a summary of motions. Again the "significant" motions (4 rms) are indicated. The value for roll was derived from spectrum area, that for pitch and accelerations from the rms of the basic data. (Unless there are significant linear trends in the data the differences are slight between "raw" and "spectrum" rms.) The last three items in the list involve various stages in the radar data reduction. The first is the slant range as recorded. The "vertical range is $R_c(t)$ of the radar analysis. This entry is essentially the vertical component of the range relative to the position of the accelerometer package. The number was derived from the spectrum. The last entry is the significant displacement at the radar (significant doubly integrated acceleration). It too was derived from spectrum analyses.

In a sense, the table at the bottom of the tabulation contains the final numerical answers. Items in the first column pertain to the uncorrected Tucker Meter signal. The second column pertains to the mean dynamic

head developed in conjunction with the analysis of the Tucker meter, and the third column pertains to wave elevations derived from the radar system. The first row in the table is the number of double amplitudes found in the middle 16-1/2 minutes of the sample. Below this are noted the maximum height found and the averages of the 1/10 and 1/3 highest double amplitudes. The final line in the table is the significant (4 rms) height derived from the spectral analyses. Ordinarily it is expected that the last two lines of the table will be about the same.

At the right of any even page are plots of the five computed spectra. It was decided to standardize the frequency scale from 0 to 2 rad/sec. In the great majority of intervals everything of interest is contained in this range. In some intervals one spectrum or another is non-negligible beyond 2 rad/sec but nothing much has been seen beyond 2.5 rad/sec for any of the quantities analyzed except in the stress spectrum where something may often be noticed around the frequency of the first mode of vertical vibration. The folding frequency of the analyses is above 20 rad/sec; no aliasing is expected, Reference 3.

The stress and roll spectra are plotted together. The vertical scale is for the stress spectrum. The roll spectrum has been multiplied by the factor noted in the legend before plotting. Dimensions of the stress spectral density are ($kpsi^2$/rad/sec) and those of the roll spectral density are (deg^2/rad/sec).

All three wave related spectra (Tucker, mean dynamic head, and radar) are plotted together to the same scale. The dimension of the wave spectral density is ($feet^2$/rad/sec). In the wave spectrum plot there is a vertical (slightly joggled) dashed line. This line marks the position of the low frequency cutoff, ω_o, discussed in Reference 4 in conjunction with double integration of the vertical accelerations. It is correct to interpret the position of this line as meaning that the double integration has been done correctly for higher frequencies, and incorrectly for lower frequencies.

There are several details about the spectrum analyses which are not documented in the plots because they are constant throughout the data reduction. First, the normalization of the spectra is such that the spectrum area equals variance. All spectra are derived from a Fast Fourier Transform analysis of an 8192 point sample. The fundamental results is 4096 spectral estimates of 2 degrees of freedom each. These estimates are uniformly spaced in frequency at a delta-frequency of 0.00511 rad/sec. In order to improve statistical reliability, the basic spectral estimates were averaged in blocks of 20 estimates at intervals of 10 estimates. The resulting averages are thus equi-speced on the frequency scale at intervals of $\Delta\omega = 0.0511$ rad/sec. This also means that adjacent spectral estimates as shown in the plot are not quite independent -- to about the same degree as spectral estimates from the older autocorrelation methods are not independent.

As a result of the averaging, each spectral estimate has 40 degrees of freedom associated with it. Accordingly, the 90% confidence bounds on the spectra shown in the charts may be formed by multiplying the values given by 0.72 and 1.51. Had the process sampled continued indefinitely and a large number of 20.5 minute samples been obtained and analyzed, nine out of ten of these new estimates of spectral density would be expected to lie within the bounds so constructed. The practical implication is simply that the influence of sampling variability upon the given numerical results is roughly the same as that associated with the result of most other full scale wave measurement exercises.

The last detail of the spectrum analysis is the "total degrees of freedom." This number is included in parentheses at the end of each line of legend because it depends upon the shape of each individual spectrum. It is an estimate of the proper number of degrees of freedom to use in constructing confidence bounds on the sample variance. If each of the numbers in the present 8192 point time histories had been picked randomly the "total degrees of freedom" would be 8191. This is not the case -- adjacent members of all the present time series are highly correlated so that the equivalent "random" sample size is much smaller. In the present data set the "total degrees of freedom" (TDF) is expected to vary between 60 and 600. Approximate 90% confidence bounds on the variances assuming a Normal zero mean process, may be constructed by multiplying the estimate by two factors derived from the percentage points of the Chi-square distribution. Examples of the values of these factors are given as follows:

TDF	Factor for Lower Bound	Factor for High Bound
60	.72	1.32
120	.80	1.27
200	.84	1.17
400	.89	1.12
600	.91	1.10

These are factors for the variances. The square root applies to the rms values so that very roughly the 90% confidence bounds on rms range from the sample rms ± 15% for TDF = 60 to the sample rms ± 5% for TDF = 600. The practical implications of these results are quite similar to those mentioned in connection with the confidence bounds on the spectra. There is only so much "precision" obtainable from one 20 minute sample of wave elevation -- that which was attacined in the present work appears comparable to that achieved in the past in similar studies. With respect to comparisons between wave meters or between data and predictions of rms ship responses there can be little justification to a concern about differences of 5 to 15% magnitude.

The sample time histories on the odd numbered pages need little explanation, except perhaps to say that the duration of the sample shown (8-1/2 minutes) was a compromise between a desire to display as much of

the 16-1/2 minutes of derived wave time histories as was possible in one page; and the desire to spread the time scale out so that individual fluctuations were visible for intervals involving high ship speed in head seas. To produce the charts an 8-1/2 minute portion of the available 16-1/2 minutes of sample was chosen such that the largest radar wave double amplitude is shown -- as well as (if possible) the largest mean dynamic head double amplitude.

It may be fairly asked why the effort in producing plotted time histories for each interval was considered worthwhile. The answer to the question is fairly simple. While the present data in its original analog form has been scanned systematically by eye, the process involved oscillograph records with a time scale of about 15 minutes to the inch. At this time compression only a gross idea of what was happening can be formed, no detailed assessment of the believability of the data can be made, and, most importantly, the odd malfunction which is enough to upset the spectrum estimates or the statistics may often go unnoticed. This last is considered most important in the radar data. It was pointed out in References 3 and 5 that an attempt was made to weed out intervals where the radar had evidently lost signal and re-established a new reference range. In this process only the most obvious instances could be identified; no guarantees could be made that all instances of moderate or small magnitude had been eliminated.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

So that more precise correlations between full scale observations and analytical and model results could be carried out, one of the objectives of the instrumentation program for the SL-7 class container ships was the provision of instrumental measures of the wave environment. To this end, two wave meter systems were installed on the S.S. SEA-LAND McLEAN. Raw data was collected from both systems during the second (1973-1974) and third (1974-1975) winter data collecting seasons.

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It was the purpose of the present work to reduce this raw data, to develop and implement such corrections as were found necessary and feasible, and to correlate and evaluate the final results from the two wave meters. In carrying out this work it was necessary to at least partly reduce several other channels of recorded data, so that, as a by-product, reduced results were also obtained for midship bending stresses, roll, pitch, and two components of acceleration on the ship's bridge.

As the work progressed it became evident that the volume of documentation required would grow beyond the usual dimensions of a single technical report. For this reason the analyses, the methods, the detailed results, discussions, and conclusions are contained in a series of ten related reports.

This report is one of the six in the series in which the detailed results of the data reduction process are presented. Included in this report is the reduced data from the Second Season Voyage 33.

METRIC CONVERSION FACTORS

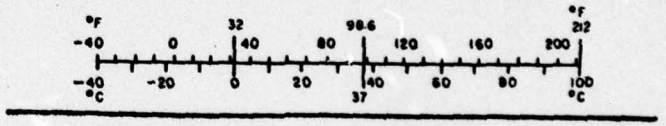
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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